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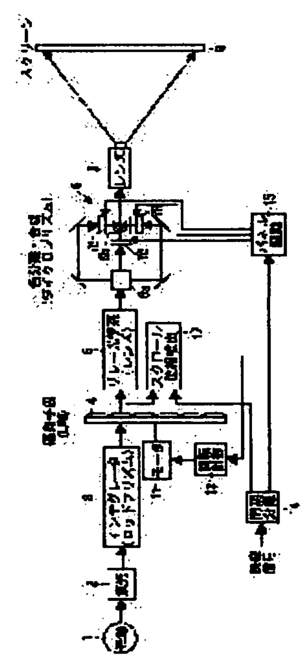
(54) PROJECTION TYPE VIDEO DISPLAY AND ILLUMINATOR

(57)Abstract:
PROBLEM TO BE SOLVED: To provide a projection type video display in which optical scrolling is performed on a hold type display element with an optical system which can be small-sized and deterioration in the image quality called as hold blurring during displaying moving images can be improved.
SOLUTION: A lens array wheel 4 receives the light projected in the direction parallel to the rotation axis of the wheel and cyclically produces polarization in the light. The light cyclically scrolls on respective liquid crystal display panels 7R, 7G, 7B to produce the effect of substantial intermittent illumination to decrease hold blurring. A panel driving part 15 begins to supply the pixel driving signals in the next frame to the pixels present in the position where the illumination region passes on the liquid crystal display panels 7R, 7G, 7B.



LEGAL STATUS
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CLAIMS

[Claim(s)]
[Claim 1]
An optical deflection means of a revolution actuation mold to make the light concerned produce a cyclic deflection in case it is made to penetrate or reflect in response to the irradiated light, The color separation means which divides the light from an optical deflection means into the three primary colors, and is respectively led to three hold mold display devices, A projection means to compound and project each color image light pass each hold mold display device, The projection mold graphic display device characterized by being constituted so that each colored light which is equipped with the component driving means which gives a pixel driving signal to each hold mold display device, and is condensed in an area smaller than the component concerned on each hold mold display device may be scrolled cyclically.
[Claim 2]
It is the projection mold graphic display device characterized by being constituted so that it may begin to supply the pixel driving signal of the following frame to the pixel which exists in the location where a lighting field passes said component driving means on each hold mold display device in a projection mold graphic display device according to claim 1.
[Claim 3]
The projection mold graphic display device characterized by being constituted so that a pixel driving signal may be supplied by N times (N is two or more integers) of a frame rate and the lighting timing to a pixel and the time of response flattening of the pixel concerned may be made in agreement in a projection mold graphic display device according to claim 2.
[Claim 4]
The projection mold graphic display device characterized by being constituted so that the pixel driving signal which emphasized change may be supplied and delay compensation may be performed in a projection mold graphic display device according to claim 3 rather than the pixel driving signal with which the need response value of a pixel is acquired.
[Claim 5]
The projection mold graphic display device characterized by having the table on which the data of the pixel driving signal which emphasized said change with the last pixel value of a before frame and this pixel value are obtained in a projection mold graphic display device according to claim 4.
[Claim 6]
The projection mold graphic display device characterized by having the control means which carries out amendment control of the deflection period so that the gap with a frame period and the deflection period by the optical deflection means may be detected, this gap may be canceled in a projection mold graphic display device according to claim 1 to 5 and a blank may arise uniformly again.
[Claim 7]
The projection mold graphic display device characterized by being constituted so that control which brings the brightness value of the pixel which becomes settled in a projection mold graphic display device according to claim 6 in the response of the pixel at the time of producing said gap

and the optical exposure period to the pixel concerned close to the schedule brightness value when not producing a gap may be performed.

[Claim 8]

The projection mold graphic display device characterized by setting up the value which emphasized change rather than the desired value of a pixel response in a projection mold graphic display device according to claim 7 according to said gap, and supplying a pixel driving signal.

[Claim 9]

The projection mold graphic display device characterized by controlling the supply timing of a pixel driving signal according to said gap in a projection mold graphic display device according to claim 7.

[Claim 10]

The projection mold graphic display device characterized by having the rod prism for leading the light which outgoing radiation was carried out and was condensed from the light source in the projection mold graphic display device according to claim 1 to 9 to an optical deflection means.

[Claim 11]

It is the projection mold graphic display device characterized by having the taper configuration so that said rod prism may ease distribution of light in a projection mold graphic display device according to claim 10.

[Claim 12]

It is the projection mold graphic display device characterized by being the lens array wheel which said optical deflection means arranges the function part which consists of two or more convex lenses disc-like along with a circumferencial direction in a projection mold graphic display device according to claim 1 to 11, and changes.

[Claim 13]

It is the projection mold graphic display device characterized by being the configuration which establishes said optical deflection means for prism in a projection mold graphic display device according to claim 1 to 11, enabling a free revolution, and changes.

[Claim 14]

It is the projection mold graphic display device characterized by consisting of the disc member which has the light transmission section by which said optical deflection means was formed in a whirl in the projection mold graphic display device according to claim 1 to 11, and has a reflector to fields other than this light transmission section.

[Claim 15]

It is the projection mold graphic display device characterized by consisting of the cylindrical member by which the light transmission section and the reflective section were formed by turns periodically [said optical deflection means] to a peripheral surface in the projection mold graphic display device according to claim 1 to 11.

[Claim 16]

said rod prism be a projection mold graphic display device characterize by be bend so that the direction of optical incidence may differ from the direction of optical outgoing radiation in a projection mold graphic display device according to claim 10 or 11 , and for an optical deflection means consist of the cylindrical member by which the light transmission section and the reflective section be periodically formed by turns in the peripheral surface , and locate all or some of said rod prism inside said cylindrical member .

[Claim 17]

The projection mold graphic display device characterized by being constituted so that the light which has arranged said disc member aslant to the optical direction of radiation, prepared the auxiliary mirror in the location which receives the light from the reflector of said disc member in the projection mold graphic display device according to claim 14, and was reflected by the auxiliary mirror may be led to the light transmission section of said disc member.

[Claim 18]

It is the projection mold graphic display device characterized by for said disc member consisting of a transparence member in a projection mold graphic display device according to claim 17, and forming the reflector in front flesh-side both sides of this transparence member.

[Claim 19]
Each colored light by which color separation was carried out with said color separation means in the projection mold graphic display device according to claim 1 to 18 is a projection mold graphic display device characterized by being constituted so that it may be mutually led to the hold mold component for each colors by the equal optical path length.
[Claim 20]
A means to compound a means to separate 2 of three-primary-colors light light and other 1 light on the optical axis of the light before color separation, and the separated three primary colors, in a projection mold graphic display device according to claim 19 is arranged. The optical path of 2 light and the optical path of 1 light are a projection mold graphic display device which is made into the symmetry and characterized by being constituted so that 1 light in it may be separated in a part in the middle of the optical path of said 2 light and it may be led on said optical axis centering on said optical axis.
[Claim 21]
In the lighting system of the revolution actuation mold which makes the light concerned produce a cyclic deflection in case it is made to penetrate in response to the light irradiated from the light source The lighting system periodically characterized by having the cylindrical member in which the light transmission section and the reflective section were formed by turns, changing, and locating said all or some of rod prism inside said cylindrical member to the rod prism of the bending mold with which the direction of optical incidence differs from the direction of optical outgoing radiation, and a peripheral surface.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application]
This invention relates to a projection mold graphic display device and a lighting system.
[0002]
[Description of the Prior Art]
Displays, such as a liquid crystal display panel (LCD), a digital micro mirror device (DMD), and a plasma display panel (PDP), are called the hold mold display. LCD etc. means maintaining the condition till the next image output to a cathode-ray tube (CRT) carrying out an impulse-like image output, as for this, as shown in drawing 1 . On such a hold mold display, when a dynamic image is displayed, unlike CRT, there is a problem that an image will become not clear.
[0003]
It has been thought that these image quality degradation at the time of displaying a dynamic image conventionally is what is depended on the lateness of a display response of a device. However, when the speed of response of a display device improves and it becomes a real time temporarily, it has turned out that a certain fixed image quality degradation is not avoided, as visual research progresses in recent years. Such image quality degradation is called a hold BURA ring (Hold Bluring).
[0004]
A hold BURA ring is a phenomenon which is not produced in the display device of impulse outputs, such as CRT, as it is based on the superimpose effect of human being's visual-information-processing system and is shown in drawing 2 . In case human being observes a dynamic image, he pursues the body in a dynamic image by the look. Since the slew rate of an eyeball cannot change rapidly at this time, by the refresh period (17ms) of the usual dynamic image, it exercises by whenever [about 1 fixed-speed]. However, in a hold mold display device, as shown in drawing 3 and drawing 4 (a), the same image is outputted to the same location between place commuter's tickets (17ms). For this reason, as shown in drawing 4 (b) and drawing 5 (a), the image currently displayed to the look location will retreat relatively, and the image accompanied by the motion which retreats is projected on a retina.
[0005]
However, these are the things in the preceding paragraph of a visual-information-processing system, and the rate recognized actually is fully slower than 17ms. As these images are shown in drawing 5 (b), addition within a fixed period is performed and the integrated image is recognized as vision. Consequently, the image recognized becomes the blurred thing which piled up the locus which moved on the retina at a fixed period. This addition period is known as a Bloch theorem, and it is said that it is 50ms - about 80ms. On the other hand, in the case of CRT, as shown in drawing 6 (a) and (b), the image outputted for a moment is only integrated. Since the image which returns to a look is not projected on a retina even if imitation integrates, a clear image will be recognized.
[0006]
[Problem(s) to be Solved by the Invention]

The most general technique of improving a hold BURA ring is bringing close to CRT. Since CRT is an impulse output, the above problems are not generated. For this reason, the most leading approach of raising the cine-mode-display property of a hold mold display is performing an intermittent display by carrying out the intermittent exposure of liquid crystal or the exposure light to DMD, as shown in drawing 7 (a) and (b) (refer to JP,9-325715,A: IPC G09F 9/35).
[0007]
However, in order to restrict irradiation time to about 60% actually, the brightness of liquid crystal also falls to 60%. Moreover, a limit of the irradiation time of 60% cannot be said to be thing sufficient as an improvement of image quality degradation by the hold failure. Although an improvement effect goes up the more the more it shortens irradiation time, though natural, that a bright back light is needed or a power source etc. is enlarged etc. poses the problem that lifting of cost is big.
[0008]
Moreover, such an approach is difficult to realize in the liquid crystal projector which uses the lamp of high power. The damage to a lamp is intense and the flash of a lamp affects a life. Moreover, also when a shutter ring is performed, since many of light by which the shutter was carried out serves as heat, the problem of heat dissipation produces it.
[0009]
A back light is separated in a direct viewing type liquid crystal display, and there is a method (refer to JP,2001-235720,A: IPC G02F 1/133) of acquiring the same effectiveness as a shutter ring by scrolling each flash. There is a problem that adjustment of a synchronization is difficult and display brightness falls like the approach which also mentioned this approach above. Moreover, a circuit is also enlarged and a manufacturing cost increases substantially.
[0010]
Moreover, the approach of inserting a black level display for every fixed period in the case of the display of a hold mold display is proposed (refer to JP,11-109921,A: IPC G09F 9/36). Usually, this fixed period is located between the refresh periods of a frame, for example, a period displays an image for 9ms in 17ms period, and the remaining 8ms periods take the approach of displaying black. Although a synchronization is stabilized when this approach is used, lowering of display brightness is not avoided. Moreover, in the case of liquid crystal, a device with a quick speed of response is needed.
[0011]
There is frame rate conversion as the hold BURA ring control approaches other than an intermittent display. this — the case of a hold mold display — 17ms period — as a result of showing the same image, paying attention to Bure's arising, an intermediate image is shown at this period. In case a 60Hz image is specifically outputted, 60 images which correspond in the medium of each image to each image are generated, and it displays as a 120Hz image. The period when the same image which causes a hold BURA ring as a result is shown serves as half. The BURA ring recognized as a result serves as half, and an image clearer than the time of displaying a 60Hz image is obtained.
[0012]
However, a certain amount of accuracy is required of a middle image, and this approach cannot be generating such a medium image certainly with a current technique.
[0013]
The approach of carrying out optical scrolling on a panel by the condensing mirror is indicated by JP,2002-6815,A (G09G 3/36) about the liquid crystal projector. However, in the condensing system (polygon mirror) currently indicated here, in order for reflex action to perform optical scrolling, when a projector is constituted, there is a fault to which optical system becomes very large.
[0014]
In view of the above-mentioned situation, this invention performs optical scrolling on a hold mold display device in the optical system which can be miniaturized, and aims at offering the projection mold graphic display device which can improve image quality degradation in the case of the cine mode display called a hold BURA ring.

[0015]
[Means for Solving the Problem]
An optical deflection means of a revolution actuation mold to make the light concerned produce a cyclic deflection in case the projection mold graphic display device of this invention is penetrated and/or reflected in response to the irradiated light, The color separation means which divides the light from an optical deflection means into the three primary colors, and is respectively led to three hold mold display devices, A projection means to compound and project each color image light pass each hold mold display device, It has the component driving means which gives a pixel driving signal to each hold mold display device, and is characterized by being constituted so that each colored light condensed in an area smaller than the component concerned on each hold mold display device may be scrolled cyclically.
[0016]
If it is the above-mentioned configuration, since each colored light condensed in an area smaller than the component concerned on each hold mold display device will be scrolled cyclically, the intermittent exposure of light will be substantially performed to a hold mold display device, and a hold BURA ring can be controlled. And since the optical deflection means for producing optical scrolling makes the light concerned produce a cyclic deflection in case it is made to mainly penetrate in response to the irradiated light, compared with a system like a polygon mirror, it becomes easy to miniaturize [of optical system] it.
[0017]
Said component driving means is good to be constituted so that it may begin to supply the pixel driving signal of the following frame to the pixel which exists in the location which a lighting field passes on each hold mold display device. According to this, it becomes easy to double the exposure period (at the time of a display) of scrolling light at the response termination event (at the display desired value achievement event) of a pixel.
[0018]
It is good to be constituted so that a pixel driving signal may be supplied by N times (N is two or more integers) of a frame rate and the lighting timing to a pixel and the time of response flattening of the pixel concerned may be made in agreement. Here, the duplex image by brightness change can be reduced by making in agreement the lighting timing to a pixel, and the time of response flattening of the pixel concerned like the above, although brightness change of a pixel will arise during the exposure period of scrolling light and a duplex image will be sensed since the response of a pixel changes exponentially.
[0019]
In the configuration which attains flattening of the above-mentioned pixel response, it is good to be constituted so that a pixel driving signal more excessive than the pixel driving signal with which the need response value of a pixel is acquired may be supplied and delay compensation may be performed. According to this, also when the speed of response of a pixel is low, it can respond. And in this configuration, it is good to have the table from which the data of said excessive pixel driving signal are obtained with the last pixel value of a before frame, and this pixel value.
[0020]
It is good to have the control means which carries out amendment control of the deflection period so that the gap with a frame period and the deflection period by the optical deflection means may be detected, this gap may be canceled and a blank may arise uniformly again. According to this, also when dispersion is in the rotational accuracy of an optical deflection means, it can respond.
[0021]
Moreover, it is good to perform control which makes in agreement with the schedule brightness value when not producing a gap the brightness value of the pixel which becomes settled in the response of the pixel at the time of producing the above-mentioned gap, and the optical exposure period to the pixel concerned. According to this, the lack of flattery of brightness change is cancelable. According to said gap, a value higher than the desired value of a pixel response is set up, and you may make it supply a pixel driving signal, or may make it control the

supply timing of a pixel driving signal in this configuration according to said gap.
[0022]
You may have the rod prism for leading the light which outgoing radiation was carried out and was condensed from the light source to an optical deflection means. Moreover, this rod prism is good to have the taper configuration so that distribution of light may be eased.
[0023]
May use the lens array wheel which arranges the function part which consists of two or more convex lenses disc-like along with a circumferencial direction as said optical deflection means, and changes, and May use the scroll prism which forms prism, enabling a free revolution and changes, and Even if it uses what consists of the disc member which has the light transmission section formed in a whirl, and has a reflector to fields other than this light transmission section, it may give up, and the cylindrical member by which the light transmission section and the reflective section were periodically formed by turns in the peripheral surface may be used. Moreover, rod prism is bent so that the direction of optical incidence may differ from the direction of optical outgoing radiation, an optical deflection means may consist of the cylindrical member by which the light transmission section and the reflective section were periodically formed by turns in the peripheral surface, and said all or some of rod prism may be located inside said cylindrical member. Moreover, the lighting system of this invention is set to the lighting system of the revolution actuation mold which makes the light concerned produce a cyclic deflection in case it is made to penetrate in response to the light irradiated from the light source. To the rod prism of the bending mold with which the direction of optical incidence differs from the direction of optical outgoing radiation, and a peripheral surface, periodically, it has the cylindrical member in which the light transmission section and the reflective section were formed by turns, changes, and is characterized by locating said all or some of rod prism inside said cylindrical member.
[0024]
The configuration which has the light transmission section formed in said whirl, and the disc member concerned may be aslant arranged to the optical direction of radiation, and an auxiliary mirror may be prepared in the location which receives the light from the reflector of said disc member, and you may constitute so that the light reflected by the auxiliary mirror may be led to the light transmission section of said disc member. Said disc member consists of a transparence member, and the reflector may be formed in front flesh-side both sides of this transparence member.
[0025]
In these projection mold graphic display devices, each colored light by which color separation was carried out with said color separation means is good to be constituted so that it may be mutually led to the hold mold component for each colors by the equal optical path length. In this configuration, centering on said optical axis, a means to compound a means to separate 2 of three-primary-colors light light and other 1 light on the optical axis of the light before color separation, and the separated three primary colors is arranged, and the optical path of 2 light and the optical path of 1 light may be made into the symmetry, and they may be constituted so that 1 light in it may be separated in a part in the middle of the optical path of said 2 light and it may be led on said optical axis.
[0026]
[Embodiment of the Invention]
Hereafter, the projection mold graphic display device of the operation gestalt of this invention is explained based on drawing 8 thru/or drawing 41 .
[0027]
(Operation gestalt 1)
Drawing 8 is the block diagram having shown the projection mold graphic display device of this operation gestalt. The light source 1 consists of an extra-high pressure mercury lamp, a metal halide lamp, a xenon lamp, etc. The condensing section 2 consists of the combination of the ellipse mirror reflected in response to the light by which outgoing radiation was carried out from the light source 1 or a parabolic mirror, and a condenser lens etc. Incidence of the light

condensed in the condensing section 2 is carried out to an integrator (rod prism) 3, after it repeats a total reflection operation by the inner surface, it serves as the uniform surface light source, and outgoing radiation is carried out. And outgoing radiation of the light integrated in this way is carried out towards the lens array wheel (LAW) 4 which is an optical deflection means. the liquid crystal display panel top which mentions the optical exposure field on the lens array wheel 4 (magnitude) later — setting — the die length of the width, and abbreviation — it is the same and is considering as the magnitude from which the vertical die length is set to one third. In addition, if what has the taper configuration to which the field by the side of outgoing radiation becomes large rather than the field by the side of light-receiving as an integrator 3 is used, in outgoing radiation light, the distribution can be eased as much as possible.

[0028]

The lens array wheel 4 arranges two or more convex lens function parts in a disc configuration along with a circumferencial direction, and grows into it. A convex lens function part has the configuration which cut off the usual convex lens to fanning. This lens array wheel 4 makes the core of that disc configuration a center of rotation (revolving shaft), and by the motor 11, revolution actuation is carried out and it receives light from a direction parallel to said center of rotation (revolving shaft). thereby, two or more convex lens function parts pass cyclically the optical outgoing radiation side side of said integrator 3 — ******** — the periodic location of a convex lens function part — a variation rate will arise and an optical deflection will be performed periodically.

[0029]

The relay lens optical system 5 carries out incidence of the deflected light, and performs image transfer to color separation dichroic prism 6a in the image light product 6. It separates into R (red) light, G (green) light, and B (blue) light, and the light which carried out incidence to color separation dichroic prism 6a is led to liquid crystal display panel 7G liquid crystal display panel 7R for R, and for G, and liquid crystal display panel 7B for B, respectively. The scrolling exposure of the colored light (an exposure configuration is the shape of a strip of paper) led to each liquid crystal display panels 7R, 7G, and 7B is respectively carried out to the same timing on the panel concerned by the optical deflection by the aforementioned lens array wheel 4. The situation of this scrolling exposure is shown in drawing 10 thru/or drawing 16 . In addition, in these drawing 10 thru/or drawing 16 , the member of the shape of a lens located between the lens array wheel 4 and the liquid crystal display panel expresses the relay optical system 5, color separation dichroic prism 6a, etc.

[0030]

And each colored light which carried out incidence to each liquid crystal display panels 7R, 7G, and 7B is modulated in the state of the response (whenever [light transmission]) of the pixel on the panel concerned, and each color image light obtained by this modulation is compounded in color composition dichroic prism 6b, turns into color image light, and is projected on a screen 9 with the projection lens 8.

[0031]

Thus, it displays that only some periods in a frame period pay their attention to 1 pixel of the panel concerned when the illumination light of the shape of a strip of paper of each color scrolls cyclically on the liquid crystal display panel 7, and as a result of the remaining periods' serving as black, an intermittent display is realized and the BURA ring at the time of displaying a dynamic image is improved. For example, when a strip-of-paper-like lighting field is set to one third of the whole panels (screen), as shown in drawing 17 (a), (b), and (c), it becomes intermittent display and equivalence of being non-display, during 2/tertiary stage by 1 / display during a tertiary stage.

[0032]

Next, the signal-processing system is explained. The panel actuator 15 drives each liquid crystal display panels 7R, 7G, and 7B based on the inputted video signal. That is, the component driver voltage which sets up whenever [light transmission / of each pixel of each liquid crystal display panel] based on a video signal is generated, and it gives each pixel. A synchronizing separator circuit 14 takes out a Vertical Synchronizing signal from a video signal, and gives it to the

scrolling phase detecting element 12. The scrolling phase detecting element 12 detects phase contrast from the revolution period of the lens array wheel 4, and a vertical synchronization. The revolution period information on the lens array wheel 4 can be acquired by the configuration of a rotary encoder. The roll control section 13 which controls a revolution of a motor 11 controls to make the revolution period of the reception from the scrolling phase detecting element 12, and the lens array wheel 4 the signal which shows said phase contrast agree in a vertical synchronization. This content of control is shown in the flow chart of drawing 9 . The supply voltage (or a pulse number, pulse width, etc.) to a motor 11 is increased in order to raise rotational speed, if a revolution period is late for a vertical synchronization, and it decreases, and if in agreement, supply voltage (or a pulse number, pulse width, etc.) to a motor 11 will be left intact in order to make rotational speed low, if early.

[0033]

By the way, if the speed of response of a liquid crystal display panel is high-speed, it will be satisfactory, but since speed of response sufficient by the usual liquid crystal display panel is not obtained, it arises that the last response of a pixel is not completed during the exposure period of scrolling light. Unless the last response of a pixel is completed for it to come, the brightness value corresponding to image data will be acquired. Then, as shown in drawing 18 , the following frame data are written in a pixel immediately after exposure light scrolls. The example of a response of liquid crystal is shown in drawing 19 . As shown in drawing, in order that liquid crystal may react, ideally **2 It comes out and an optical exposure is made to be performed in the shown period. That is, as shown in drawing 20 , suppose that the timing of a liquid crystal response and a display (panel lighting) is set up. However, the liquid crystal panel used for the usual transparency mold liquid crystal projector cannot answer in a frame period, i.e., 17ms period. For this reason, even if it results in the write-in timing of a frame, the image of two frames ago will remain on a liquid crystal panel, and the double image will always be displayed through between the whole term. When the intermittent display by scrolling of exposure light is performed using such a panel, a result as which a double image is emphasized is brought and the impression that image quality improved is not acquired. For this reason, the response in a period is realized for 17ms using the technique of an overdrive in the data writing to a panel, and a double image is reduced. In a transparency mold liquid crystal projector, in making liquid crystal answer 100->200 for example, it writes in and suppose that it answers only to 180 within a period. However, what is necessary is just to use not 200 but 230 as an input value in this case, if it writes in when not 200 but 230 is inputted, for example, and it answers to 200 within a period. This situation is shown in drawing 21 . These are the examples of the panel which does not answer in 17ms. In drawing 21 (a), it turns out that the desired value is answered in the two-frame period. For this reason, the response of liquid crystal is made quick by emphasizing a changed part, as shown in drawing 21 (b). Consequently, liquid crystal answers within 17ms period, and it becomes possible to reduce a double image. Moreover, as shown in drawing 19 , as for exposure light, it is desirable to the period of frame writing to carry out abbreviation coincidence. It is because the double image has occurred at the period when the liquid crystal response is changing. In this case, it is possible to write in the period of exposure light, as shown in drawing 18 , and to double it just before a period. However, in this case, by the exposure start point, it is a strong double image and a comparatively strong double image is recognized from the image displayed as a result. In this case, **2 of drawing 19 It is alike, and a comparatively good result is obtained by writing in and exceeding a period a little so that it may be shown. This is in the so-called condition of the thin Mie image an image comes to look on both sides of a motion part like a thin shadow. The result that this condition of subjectivity image quality is higher is obtained. Although the following examples explain as what doubles exposure light just before frame writing in order to avoid confusion, it writes not giving constraint at all to using the technique of raising subjective image quality in addition by not being limited to this exposure pattern and making a frame write-in period carry out abbreviation coincidence like the above-mentioned explanation.

[0034]

(Operation gestalt 2)

The configuration of the projection mold graphic display device of the operation gestalt 2 is shown in drawing 26 . And the projection mold graphic display device of this operation gestalt that can solve this trouble is explained, drawing 21 thru/or drawing 25 , and drawing 27 showing a trouble.

[0035]

The liquid crystal response condition by the operation gestalt 1 is typically shown in drawing 21 (a), and the liquid crystal response condition by the operation gestalt 2 is typically shown in drawing 21 (b).

[0036]

Here, even when it becomes an exponential change and an ideal optical exposure is performed, the response of liquid crystal has change of brightness during a display period, as shown in drawing 22 , and this will become a double image and it will be recognized. Then, the lighting timing to a liquid crystal pixel and the time of response flattening of the liquid crystal pixel concerned are made in agreement. As shown in drawing 23 , specifically, the writing to a liquid crystal pixel is performed by the integral multiple of a frame rate. For example, by the system driven by 60Hz, it writes in by 120Hz. And liquid crystal is made to answer to a desired value (desired value) within the first non-display 1 / 120-second period, and a liquid crystal response is set constant in 1 / 120-second period which is the remaining display periods.

[0037]

However, in 120Hz, since not almost all liquid crystal can answer, it performs overdrive control in the overdrive circuit 21 shown in drawing 26 so that liquid crystal may answer the value of hope. Overdrive control inputs a bigger change value than the value of hope into liquid crystal, and compensates delay. It writes in, even if it inputs the value for which it wishes, as shown in drawing 22 , and liquid crystal cannot answer within a period in many cases. For this reason, in making liquid crystal answer 100->200 for example, it writes in and suppose that it answers only to 180 within a period. However, what is necessary is just to input not 200 but 230, if it writes in noting that not 200 but 230 is inputted, for example, and it answers to 200 within a period. The value to which liquid crystal answers to a desired value within this write-in period is determined by the value of the current condition of liquid crystal, and a target condition, i.e., a front frame, and the value in the frame to write in. Moreover, since these values are not linearity, they are not a function and are determined in table. What is necessary is just to consider a table as the configuration which considers a pixel value (value in the frame to write in) to write in the pixel value (value in a front frame) of the condition before writing in, and a degree as an input (read-out address). And on this table, the input data value (excessive write-in value) to the panel needed since it becomes a pixel value (desired value) to write in after 17ms as output data is acquired. for this reason, the value which the pixel value of a frame tends to be memorized to a frame memory 22 (refer to drawing 26) before being alike, and it is going to write in with the value on a frame memory 22 to each pixel — the address — carrying out — a table — reference — the pixel data (input data value to a panel) to write in are obtained from a table by things.

[0038]

Usually, the comparison of a drive and an overdrive is shown in drawing 24 . This drawing (a) is the liquid crystal response of a drive usually, and this drawing (b) is the liquid crystal response of an overdrive. The relation between the response condition of this drawing (b) and a panel lighting period is shown in drawing 25 . A panel lighting period and the time of response flattening of the liquid crystal pixel concerned will be in agreement, brightness change within a panel lighting period is suppressed, and duplex image prevention is achieved so that this drawing 25 may show.

[0039]

Drawing 27 is drawing which expressed the write-in timing of the overdrive circuit 21 on the display device. Although the following frame data are written in from the part (part where the lighting field passed away) which the display ended, since a speed of response response which was mentioned above is required for this, overdrive writing will be performed. And by writing in the value of normal, before entering at a display period, the liquid crystal response in subsequent

display periods (remainder of an one-frame period) is held in the flat condition.

[0040]

(Operation gestalt 3)

The configuration of the projection mold graphic display device of the operation gestalt 3 is shown in drawing 30 . And this operation gestalt is explained, the trouble in the configuration of the above-mentioned operation gestalt being shown based on drawing 28 and drawing 29 .

[0041]

It is the rotational accuracy (rotational accuracy of a motor 11) of the ** lens array wheel 3 made into a problem. Although it is satisfactory if a lighting location is surely in agreement with the timing of frame writing, the rotational speed of the usual motor 11 is not stabilized thoroughly. For this reason, the exposure period (display period) of light will get mixed up in a frame period. This phenomenon is divided into two conditions (refer to drawing 19). First, an ideal condition is in the condition in which a display period carries out abbreviation agreement at the phase of a vertical synchronization, as shown in drawing 28 (a). On the other hand, a double image will be perceived when a display period shifts greatly to the phase of a vertical synchronization, as shown in drawing 28 (b). In this phase, since liquid crystal is answering, the double image as which the before frame image and the written-in frame image were displayed is displayed on the liquid crystal panel. Consequently, the image perceived also turns into a double image and is recognized as big image quality degradation. By drawing 28 , it writes in with a frame rate and the case where a rate is the same is shown. In addition, as shown in drawing 25 , when bringing forward and carrying out flattening of the pixel response, the gap with a frame period and the deflection period by the optical deflection means may be made to carry out amendment control of the deflection period so that it may be generated in the side in which the optical exposure period to a pixel is rash to the phase of a frame period.

[0042]

With this operation gestalt 3, solution by the overdrive method as shown in drawing 28 (c) is indicated to the problem of the above-mentioned double image. An overdrive here is in making a response meet the deadline so that a double image may disappear in the exposure period (display period) of light. That is, the value exceeded rather than the input pixel value is inputted as a pixel value so that a liquid crystal response may meet the deadline in the part of the exposure period (display period) of light (it emphasizes). For example, 30 is inputted, when changing to 50-100 and changing 130 to 50 from 100. These values are determined by a liquid crystal speed of response and the timing currently irradiated, and an input value is emphasized that a double image disappears to the irradiated timing (extent of phase contrast with a vertical synchronization).

[0043]

By the overdrive here, phase contrast will start the input of a table further. The desired value in this case should be determined that the area formed by the pattern of drawing 28 (c) will become the same as the area in the pattern of drawing 28 (a). For this reason, a actual write-in value is determined by the value of a front frame, the value (desired value) of the pixel data which it is going to write in, and phase contrast.

[0044]

In this case, the thing whose caution is the need is the difference with the usual overdrive and the overdrive in this operation gestalt 3. In order to write in so that the inputted pixel value may turn into a policy objective value by the usual overdrive, the final value of the frame period of a liquid crystal response is the same as that of input pixel data. Therefore, what is necessary is to compare said input pixel data and input pixel data of the following frame, in writing in the following frame, and just to determine a write-in value. On the other hand, the overdrive which considered the phase contrast of this operation gestalt 3 will change extent of an overdrive corresponding to extent of phase contrast with a vertical synchronization, and also changes the final value of a frame period by this. Therefore, the final value of a frame period does not become the same as that of input pixel data. Therefore, in writing in the following frame, it writes in the data equivalent to the final value of a frame period from the overdrive circuit 31 side to the frame memory 32, and the data equivalent to the final value of this frame period will be

compared with the input pixel data of the following frame, and a write-in value will be determined.

[0045]
Although it becomes a repeat, the difference with the usual overdrive and the overdrive which considered phase contrast is described further below. In drawing 29 , the dotted line shows the liquid crystal response at the time of using the usual overdrive. A is a pixel value (input pixel data of a frame), and liquid crystal shows a response like a continuous line by inputting a bigger value than this pixel value A into a liquid crystal display panel. What is necessary is just to perform the overdrive in the following frame in the usual overdrive based on the pixel value A, since liquid crystal has answered to a pixel value, i.e., target level, to the timing of a change of a frame. But, by the overdrive which considered phase contrast, in order to input the area of the period when light is irradiated actually as desired value, the final value of a frame period becomes like C. For this reason, the overdrive of the following frame will be performed on the basis of the value of this C. The overdrive circuit 31 carries in the interior the table on which the final value (C) of a frame period is given as resemble the input pixel data (A) of a frame, and the actual write-in value (applied voltage B) by the overdrive which considered phase contrast, and gives the final value (C) of a frame period to a frame memory 32. And in the following frame, the input pixel data of the frame and the phase contrast information received from the final value (C) and the scrolling phase detecting element 12 of said frame period received from the frame memory 32 will perform an overdrive.

[0046]
(Operation gestalt 4)
The projection mold graphic display device of the operation gestalt 4 is explained based on drawing 31 thru/or drawing 33 . With this operation gestalt, like the operation gestalt 3, although the problem of a double image is solved, the technique of being different in the operation gestalt 3 is proposed.

[0047]
The projection mold graphic display device of this operation gestalt is equipped with the memory 41 and the read-out timing-control circuit 42 which store image data as shown in drawing 31 . Image data (frame) are memorized by memory 41, and the image data of one frame ago are given to the read-out timing-control circuit 42 from the frame supplied actually. Although the read-out timing-control circuit 42 reads pixel data from memory 41 one by one and supplies this to the panel actuator 15, it adjusts the supply timing of said pixel data for phase contrast information according to reception and this topology (scrolling gap) from the scrolling phase detecting element 12. If a phase shift as this shows to (b) in drawing 33 from the condition without a phase shift shown in (a) in drawing 33 arises, this will appear as an output (topology) of a sensor (scrolling phase detecting element 12), and the write-in location (supply timing to a panel) of data will be shifted to an early period by control of the read-out timing-control circuit 42. By this, as shown in drawing 32 (c), according to a gap of a vertical synchronization and a lighting pattern, the timing which reads data, and the timing written in a liquid crystal panel will be adjusted, and display brightness will be guaranteed.

[0048]
In addition, it can change to a lens array wheel (LAW), and scrolling disc 4A can be used. This scrolling disc 4A prepares a transparence part in a part, and is equivalent to what used the remainder as the mirror. This scrolling disc 4A is shown in drawing 34 . In drawing 34 , 4Aa is a transparence part and 4Ab is a mirror part. By this, as shown in drawing 35 , only the period of the transparency part of a scrolling disc is projected on the white light by the liquid crystal display panel, and the remainder will return to the rod integrator 3 interior, and will be reflected and reused.

[0049]
Monochrome wheel 4B is shown in drawing 36 as an optical deflection means. Integrator 3' which prepared the include angle in the part which carries out incidence of the light is constituted, and cylinder-like monochrome wheel 4B is formed in the perimeter. This wheel 4B has the revolution composition of reflecting transparency and the remainder in part for every frame period, in the

outgoing radiation light of integrator 3', and obtains scrolling light on a liquid crystal panel by rotating this wheel 4B.

[0050]

Although the usual rod integrator (3) is carrying out the linear configuration, if it remains as it is, light cannot be irradiated to a peripheral surface side in monochrome wheel 4B. For this reason, incidence of the light is carried out using rod integrator 3' bent on the way. The black part of a wheel shows the reflector to the interior, and the transparency side where a white part is transparent. The light irradiated by the black reflector returns to the interior, and is reused. Since the transparency side serves as some (drawing about 1/3) fields of a screen, the light condensed by this field will be irradiated by the liquid crystal panel, and exposure light will scroll by rotating this monochrome wheel 4B.

[0051]

With the configuration shown in drawing 36 , although the optical incidence side of rod integrator 3' is bent, as shown in drawing 37 , monochrome wheel 4C of a minor diameter can also be used using rod integrator 3″ which bent the optical outgoing radiation side. In this case, although structure becomes long in a longitudinal direction, since monochrome wheel 4C of a minor diameter can be used, the motor of a high-speed revolution can be used. Generally effectiveness of a motor is high also from the field which it is easy to control the direction of a high-speed revolution, and prevents generating of a double image.

[0052]

Moreover, as shown in drawing 38 , scroll prism 4D can be used. A cube configuration is accomplished, a revolving shaft is set as a space perpendicular direction in drawing, to the optical outgoing radiation side of the rod integrator 3, four fields change an include angle periodically and meet, and this scroll prism 4D is constituted so that outgoing radiation light may scroll in an optical refraction operation.

[0053]

In addition, with the operation gestalt explained above, although the liquid crystal display panel of a transparency mold was used, it cannot restrict to this and the device which drives respectively the minute mirror arranged the shape of a liquid crystal display panel or a matrix of a reflective mold based on pixel data can be used.

[0054]

Scrolling disc 44A is shown in drawing 39 . The thick wire rectangular-head frame of drawing shows the primary image formation field to which the light from the light source is led. Moreover, in drawing, hatching shows the light reflex field of scrolling disc 44A. The A-A cross section in scrolling disc 44A is shown in drawing 40 . This drawing (a), (b), and (c) show signs that a light transmission condition changes because scrolling disc 44A rotates. To the optical axis, 45 degrees scrolling disc 44A inclines, and is arranged. And scrolling disc 44A was made to meet in the location which does not check an introductory light from the light source, and the auxiliary mirror 45 is formed. The light reflected in the light reflex field of scrolling disc 44A is led to the auxiliary mirror 45, and the light reflected by this auxiliary mirror 45 penetrates the light transmission field of scrolling disc 44A. Since the light from the light source led to the primary image formation field of scrolling disc 44A will be led to a liquid crystal display panel by a transparency operation of the light transmission field of scrolling disc 44A, and the above-mentioned reflex action, without being made useless, improvement in brightness of a display image can be aimed at.

[0055]

Although drawing 39 and scrolling disc 44A shown in 40 formed the light reflex field in one side of a transparence disc, a light reflex field may be formed in both sides of a transparence disc. By using both sides of a transparence disc for a light reflex, only one side is released from the constraint in the case of considering as a light reflex side, and can attain design easy-ization of a scrolling disc etc.

[0056]

Moreover, the exposure optical system 100 is shown in drawing 41 . The light source 101 consists of a metal halide lamp, a xenon lamp, etc., and the exposure light turns into parallel light,

outgoing radiation is carried out by the parabola reflector, and it is led to the integrator lens 102.

[0057]
The integrator lens 102 consists of lens groups of a couple, and leads the light to which outgoing radiation of each lens pair was carried out from the light source 101 to the optical incidence field of the scrolling optical system 105. The primary image formation field (lighting field for scrolling) mentioned above is made perpendicularly short to liquid crystal display panel size, and each lens of the integrator lens 102 is made perpendicularly short corresponding to this. The scrolling optical system 105 can be constituted using the lens array wheel 4, the scrolling discs 4A and 44A, etc. which were mentioned above. After the light which passed through the integrator lens 102 passes through a condenser lens 103, a mirror 104, and scrolling optical-system 105 grade, it is led to the dichroic mirrors 106a and 106b by which cross arrangement was carried out.
[0058]
Dichroic mirror 106a reflects a part for red Mitsunari, and a green light component, and a blue glow component is made to penetrate. Dichroic mirror 106a reflects a blue glow component, and a part for red Mitsunari and a green light component are made to penetrate. Dichroic mirrors 106a and 106b are arranged on the optical axis of the light before color separation (light on a primary image formation field). Moreover, color composition dichroic prism 6b is arranged on this optical axis. Centering on said optical axis, it considers as the symmetry, the green light in it is separated by the dichroic mirror 110 in a part in the middle of the optical path of said 2 light, and the optical path of 2 light (red light and green light) and the optical path of 1 light (blue glow) are drawn on said optical axis by the mirror 111. this should pass a mirror 109 and a mirror 108 from dichroic mirror 106a — pass a dichroic mirror 110 and a mirror 111 from dichroic mirror 106a with the optical path length to liquid crystal display panel 7R for red — pass a mirror 112 and a mirror 113 from dichroic mirror 106b with the optical path length to liquid crystal display panel 7G for green — the optical path length to liquid crystal display panel 7G for blue — mutual — etc. — it spreads — it has become.
[0059]
Although arranging relay optical system on the optical path of blue glow is performed, for example with the general configuration using the color composition optical system by the dichroic prism, when such optical system is diverted as it was, it arises that the direction of scrolling of exposure blue glow becomes other scrolling directions and reverse of colored light according to relay optical system. Like ****, relay optical system can be made unnecessary, using the configuration of the general color composition optical system by the dichroic prism by having made equal the optical path length to the liquid crystal display panel of each color, after carrying out color separation, and the outstanding effectiveness of the cutback of optical members will be acquired by consistency reservation and coincidence of the scrolling direction.
[0060]
In addition, it can consider as the configuration which separates into red light and cyanogen colored light, and separates green light on the optical path of cyanogen colored light, and the optical path length of each colored light can also be made equal like the above.
[Effect of the Invention]
As explained above, according to this invention, optical scrolling is performed on a hold mold display device in the optical system which can be miniaturized, and image quality degradation in the case of the cine mode display called a hold BURA ring can be improved. Furthermore, the brightness change reduction (duplex image prevention) by flattening of a pixel response, the nonconformity by revolution Bure of an optical deflection means, etc. can be canceled, and improvement in display image quality can be aimed at.
[Brief Description of the Drawings]
[Drawing 1] It is the explanatory view having shown the optical output property over the input signal of CRT and a hold mold display device.
[Drawing 2] It is the explanatory view having shown the display image and check-by-looking property in CRT.
[Drawing 3] It is the explanatory view having shown the display image and check-by-looking

property in a hold mold display device.
[Drawing 4] This drawing (a) and (b) are the explanatory views explaining generating of the duplex image in a hold mold display device.
[Drawing 5] This drawing (a) and (b) are the explanatory views explaining generating of the duplex image in a hold mold display device.
[Drawing 6] This drawing (a) and (b) are the explanatory views explaining a duplex image not occurring in CRT.
[Drawing 7] This drawing (a) and (b) are the explanatory views having shown that a duplex image was mitigated by performing intermittent illumination in a hold mold display device.
[Drawing 8] It is the block diagram having shown the projection mold graphic display device of the operation gestalt 1 of this invention.
[Drawing 9] It is the flow chart which showed that motor control was performed with an image synchronizing signal and the output of a scrolling phase detector.
[Drawing 10] It is the explanatory view having shown the situation of scrolling of the illumination light to a liquid crystal panel top.
[Drawing 11] It is the explanatory view having shown the situation of scrolling of the illumination light to a liquid crystal panel top.
[Drawing 12] It is the explanatory view having shown the situation of scrolling of the illumination light to a liquid crystal panel top.
[Drawing 13] It is the explanatory view having shown the situation of scrolling of the illumination light to a liquid crystal panel top.
[Drawing 14] It is the explanatory view having shown the situation of scrolling of the illumination light to a liquid crystal panel top.
[Drawing 15] It is the explanatory view having shown the situation of scrolling of the illumination light to a liquid crystal panel top.
[Drawing 16] It is the explanatory view having shown the situation of scrolling of the illumination light to a liquid crystal panel top.
[Drawing 17] This drawing (a), (b), and (c) are the explanatory views having shown the relation between a liquid crystal response and the liquid crystal brightness in the intermittent illumination by scrolling.
[Drawing 18] It is the explanatory view having shown the relation between the situation of scrolling on a screen, and a pixel data store.
[Drawing 19] It is the explanatory view having shown the relation of the display image quality by a liquid crystal response and the lighting period.
[Drawing 20] It is the explanatory view having shown the relation between a liquid crystal response and a lighting period.
[Drawing 21] This drawing (a) is an explanatory view having shown the case (liquid crystal response flattening) where the liquid crystal response in the case of performing a data store by **** of a synchronization was shown, this drawing (b) performed an overdrive in the first half in this store, and the data store of desired value was performed in the second half.
[Drawing 22] It is the explanatory view having shown the relation between a liquid crystal response and a lighting period.
[Drawing 23] It is the explanatory view having shown the relation between a liquid crystal response and a lighting period.
[Drawing 24] This drawing (a) shows the usual store and this drawing (b) is an explanatory view having shown liquid crystal response flattening by the overdrive.
[Drawing 25] It is the explanatory view having shown doubling lighting timing (display) at the time of liquid crystal response flattening by the overdrive.
[Drawing 26] It is the block diagram having shown the projection mold graphic display device of the 2nd operation gestalt of this invention.
[Drawing 27] It is the explanatory view having shown the relation between the situation of scrolling on a screen, and a pixel data store.
[Drawing 28] This drawing (a), (b), and (c) are the explanatory views having shown that change arises in pixel brightness by gap of the lighting period within a frame period, and its solution (the

overdrive technique).
[Drawing 29] It is the explanatory view having shown how to solve that change arises in pixel brightness by gap of the lighting period within a frame period.
[Drawing 30] It is the block diagram having shown the projection mold graphic display device of the 3rd operation gestalt of this invention.
[Drawing 31] It is the block diagram having shown the projection mold graphic display device of the 4th operation gestalt of this invention.
[Drawing 32] This drawing (a), (b), and (c) are the explanatory views having shown that change arises in pixel brightness by gap of the lighting period within a frame period, and its solution (frame read-out control).
[Drawing 33] This drawing (a) shows the usual frame read-out control, and this drawing (b) is an explanatory view having shown frame read-out control of the above-mentioned solution.
[Drawing 34] It is the explanatory view having shown other examples of an optical deflection means.
[Drawing 35] It is the explanatory view having shown the example of a configuration using the optical deflection means of drawing 34 .
[Drawing 36] It is the explanatory view having shown other examples of an optical deflection means, and this drawing (a) is a side elevation and this drawing (b) is a front view.
[Drawing 37] It is the explanatory view having shown other examples of an optical deflection means, and this drawing (a) is a side elevation and this drawing (b) is a front view.
[Drawing 38] It is the explanatory view having shown other examples of an optical deflection means.
[Drawing 39] It is the explanatory view having shown the scrolling disc which are other examples of an optical deflection means.
[Drawing 40] It is drawing having shown the A-A cross section in the scrolling disc of drawing 39 , and this drawing (a), (b), and (c) show signs that a light transmission condition changes because a scrolling disc rotates, respectively.
[Drawing 41] It is the explanatory view having shown exposure optical system.
[Description of Notations]
1 Light Source
2 Condensing Section
3 Integrator
4 Lens Array Wheel
4A Scrolling disc
4B Monochrome wheel
4C Monochrome wheel
4D Scroll prism
5 Relay Lens
6 Image Light Product
7R, 7G, and 7B Liquid crystal display panel
11 Stepping Motor
12 Scrolling Phase Detecting Element
13 Roll Control Section
14 Synchronizing Separation Section
15 Panel Actuator
21 Overdrive Circuit
22 Frame Memory
31 Overdrive Circuit
32 Frame Memory
41 Memory
42 Read-out Timing-Control Section
44A Scrolling disc
45 Auxiliary Mirror
100 Exposure Optical System

101 Light Source
102 Integrator Lens
105 Scrolling Optical System
106a dichroic mirror
106b dichroic mirror
110 Dichroic Mirror

[Translation done.]

TECHNICAL FIELD

[Industrial Application]
This invention relates to a projection mold graphic display device and a lighting system.
[0002]

[Translation done.]

PRIOR ART

[Description of the Prior Art]
Displays, such as a liquid crystal display panel (LCD), a digital micro mirror device (DMD), and a plasma display panel (PDP), are called the hold mold display. LCD etc. means maintaining the condition till the next image output to a cathode-ray tube (CRT) carrying out an impulse-like image output, as for this, as shown in drawing 1 . On such a hold mold display, when a dynamic image is displayed, unlike CRT, there is a problem that an image will become not clear.
[0003]
It has been thought that these image quality degradation at the time of displaying a dynamic image conventionally is what is depended on the lateness of a display response of a device. However, when the speed of response of a display device improves and it becomes a real time temporarily, it has turned out that a certain fixed image quality degradation is not avoided, as visual research progresses in recent years. Such image quality degradation is called a hold BURA ring (Hold Bluring).
[0004]
A hold BURA ring is a phenomenon which is not produced in the display device of impulse outputs, such as CRT, as it is based on the superimpose effect of human being's visual-information-processing system and is shown in drawing 2 . In case human being observes a dynamic image, he pursues the body in a dynamic image by the look. Since the slew rate of an eyeball cannot change rapidly at this time, by the refresh period (17ms) of the usual dynamic image, it exercises by whenever [about 1 fixed-speed]. However, in a hold mold display device, as shown in drawing 3 and drawing 4 (a), the same image is outputted to the same location between place commuter's tickets (17ms). For this reason, as shown in drawing 4 (b) and drawing 5 (a), the image currently displayed to the look location will retreat relatively, and the image accompanied by the motion which retreats is projected on a retina.
[0005]
However, these are the things in the preceding paragraph of a visual-information-processing system, and the rate recognized actually is fully slower than 17ms. As these images are shown in drawing 5 (b), addition within a fixed period is performed and the integrated image is recognized as vision. Consequently, the image recognized becomes the blurred thing which piled up the locus which moved on the retina at a fixed period. This addition period is known as a Bloch theorem, and it is said that it is 50ms - about 80ms. On the other hand, in the case of CRT, as shown in drawing 6 (a) and (b), the image outputted for a moment is only integrated. Since the image which returns to a look is not projected on a retina even if imitation integrates, a clear image will be recognized.
[0006]

[Translation done.]

EFFECT OF THE INVENTION

[Effect of the Invention]
As explained above, according to this invention, optical scrolling is performed on a hold mold display device in the optical system which can be miniaturized, and image quality degradation in the case of the cine mode display called a hold BURA ring can be improved. Furthermore, the brightness change reduction (duplex image prevention) by flattening of a pixel response, the nonconformity by revolution Bure of an optical deflection means, etc. can be canceled, and improvement in display image quality can be aimed at.

[Translation done.]

TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention]
The most general technique of improving a hold BURA ring is bringing close to CRT. Since CRT is an impulse output, the above problems are not generated. For this reason, the most leading approach of raising the cine-mode-display property of a hold mold display is performing an intermittent display by carrying out the intermittent exposure of liquid crystal or the exposure light to DMD, as shown in drawing 7 (a) and (b) (refer to JP,9-325715,A: IPC G09F 9/35).
[0007]
However, in order to restrict irradiation time to about 60% actually, the brightness of liquid crystal also falls to 60%. Moreover, a limit of the irradiation time of 60% cannot be said to be thing sufficient as an improvement of image quality degradation by the hold failure. Although an improvement effect goes up the more the more it shortens irradiation time, though natural, that a bright back light is needed or a power source etc. is enlarged etc. poses the problem that lifting of cost is big.
[0008]
Moreover, such an approach is difficult to realize in the liquid crystal projector which uses the lamp of high power. The damage to a lamp is intense and the flash of a lamp affects a life. Moreover, also when a shutter ring is performed, since many of light by which the shutter was carried out serves as heat, the problem of heat dissipation produces it.
[0009]
A back light is separated in a direct viewing type liquid crystal display, and there is a method (refer to JP,2001-235720,A: IPC G02F 1/133) of acquiring the same effectiveness as a shutter ring by scrolling each flash. There is a problem that adjustment of a synchronization is difficult and display brightness falls like the approach which also mentioned this approach above. Moreover, a circuit is also enlarged and a manufacturing cost increases substantially.
[0010]
Moreover, the approach of inserting a black level display for every fixed period in the case of the display of a hold mold display is proposed (refer to JP,11-109921,A: IPC G09F 9/36). Usually, this fixed period is located between the refresh periods of a frame, for example, a period displays an image for 9ms in 17ms period, and the remaining 8ms periods take the approach of displaying black. Although a synchronization is stabilized when this approach is used, lowering of display brightness is not avoided. Moreover, in the case of liquid crystal, a device with a quick speed of response is needed.
[0011]
There is frame rate conversion as the hold BURA ring control approaches other than an intermittent display. this -- the case of a hold mold display -- 17ms period -- as a result of showing the same image, paying attention to Bure's arising, an intermediate image is shown at this period. In case a 60Hz image is specifically outputted, 60 images which correspond in the medium of each image to each image are generated, and it displays as a 120Hz image. The period when the same image which causes a hold BURA ring as a result is shown serves as half. The BURA ring recognized as a result serves as half, and an image clearer than the time of displaying a 60Hz image is obtained.

[0012]
However, a certain amount of accuracy is required of a middle image, and this approach cannot be generating such a medium image certainly with a current technique.
[0013]
The approach of carrying out optical scrolling on a panel by the condensing mirror is indicated by JP,2002-6815,A (G09G 3/36) about the liquid crystal projector. However, in the condensing system (polygon mirror) currently indicated here, in order for reflex action to perform optical scrolling, when a projector is constituted, there is a fault to which optical system becomes very large.
[0014]
In view of the above-mentioned situation, this invention performs optical scrolling on a hold mold display device in the optical system which can be miniaturized, and aims at offering the projection mold graphic display device which can improve image quality degradation in the case of the cine mode display called a hold BURA ring.
[0015]

[Translation done.]

MEANS

[Means for Solving the Problem]
An optical deflection means of a revolution actuation mold to make the light concerned produce a cyclic deflection in case the projection mold graphic display device of this invention is penetrated and/or reflected in response to the irradiated light, The color separation means which divides the light from an optical deflection means into the three primary colors, and is respectively led to three hold mold display devices, A projection means to compound and project each color image light pass each hold mold display device, It has the component driving means which gives a pixel driving signal to each hold mold display device, and is characterized by being constituted so that each colored light condensed in an area smaller than the component concerned on each hold mold display device may be scrolled cyclically.
[0016]
If it is the above-mentioned configuration, since each colored light condensed in an area smaller than the component concerned on each hold mold display device will be scrolled cyclically, the intermittent exposure of light will be substantially performed to a hold mold display device, and a hold BURA ring can be controlled. And since the optical deflection means for producing optical scrolling makes the light concerned produce a cyclic deflection in case it is made to mainly penetrate in response to the irradiated light, compared with a system like a polygon mirror, it becomes easy to miniaturize [of optical system] it.
[0017]
Said component driving means is good to be constituted so that it may begin to supply the pixel driving signal of the following frame to the pixel which exists in the location which a lighting field passes on each hold mold display device. According to this, it becomes easy to double the exposure period (at the time of a display) of scrolling light at the response termination event (at the display desired value achievement event) of a pixel.
[0018]
It is good to be constituted so that a pixel driving signal may be supplied by N times (N is two or more integers) of a frame rate and the lighting timing to a pixel and the time of response flattening of the pixel concerned may be made in agreement. Here, the duplex image by brightness change can be reduced by making in agreement the lighting timing to a pixel, and the time of response flattening of the pixel concerned like the above, although brightness change of a pixel will arise during the exposure period of scrolling light and a duplex image will be sensed since the response of a pixel changes exponentially.
[0019]
In the configuration which attains flattening of the above-mentioned pixel response, it is good to be constituted so that a pixel driving signal more excessive than the pixel driving signal with which the need response value of a pixel is acquired may be supplied and delay compensation may be performed. According to this, also when the speed of response of a pixel is low, it can respond. And in this configuration, it is good to have the table from which the data of said excessive pixel driving signal are obtained with the last pixel value of a before frame, and this pixel value.
[0020]

It is good to have the control means which carries out amendment control of the deflection period so that the gap with a frame period and the deflection period by the optical deflection means may be detected, this gap may be canceled and a blank may arise uniformly again. According to this, also when dispersion is in the rotational accuracy of an optical deflection means, it can respond.

[0021]

Moreover, it is good to perform control which makes in agreement with the schedule brightness value when not producing a gap the brightness value of the pixel which becomes settled in the response of the pixel at the time of producing the above-mentioned gap, and the optical exposure period to the pixel concerned. According to this, the lack of flattery of brightness change is cancelable. According to said gap, a value higher than the desired value of a pixel response is set up, and you may make it supply a pixel driving signal, or may make it control the supply timing of a pixel driving signal in this configuration according to said gap.

[0022]

You may have the rod prism for leading the light which outgoing radiation was carried out and was condensed from the light source to an optical deflection means. Moreover, this rod prism is good to have the taper configuration so that distribution of light may be eased.

[0023]

May use the lens array wheel which arranges the function part which consists of two or more convex lenses disc-like along with a circumferencial direction as said optical deflection means, and changes, and May use the scroll prism which forms prism, enabling a free revolution and changes, and Even if it uses what consists of the disc member which has the light transmission section formed in a whirl, and has a reflector to fields other than this light transmission section, it may give up, and the cylindrical member by which the light transmission section and the reflective section were periodically formed by turns in the peripheral surface may be used. Moreover, rod prism is bent so that the direction of optical incidence may differ from the direction of optical outgoing radiation, an optical deflection means may consist of the cylindrical member by which the light transmission section and the reflective section were periodically formed by turns in the peripheral surface, and said all or some of rod prism may be located inside said cylindrical member. Moreover, the lighting system of this invention is set to the lighting system of the revolution actuation mold which makes the light concerned produce a cyclic deflection in case it is made to penetrate in response to the light irradiated from the light source. To the rod prism of the bending mold with which the direction of optical incidence differs from the direction of optical outgoing radiation, and a peripheral surface, periodically, it has the cylindrical member in which the light transmission section and the reflective section were formed by turns, changes, and is characterized by locating said all or some of rod prism inside said cylindrical member.

[0024]

The configuration which has the light transmission section formed in said whirl, and the disc member concerned may be aslant arranged to the optical direction of radiation, and an auxiliary mirror may be prepared in the location which receives the light from the reflector of said disc member, and you may constitute so that the light reflected by the auxiliary mirror may be led to the light transmission section of said disc member. Said disc member consists of a transparence member, and the reflector may be formed in front flesh-side both sides of this transparence member.

[0025]

In these projection mold graphic display devices, each colored light by which color separation was carried out with said color separation means is good to be constituted so that it may be mutually led to the hold mold component for each colors by the equal optical path length. In this configuration, centering on said optical axis, a means to compound a means to separate 2 of three-primary-colors light light and other 1 light on the optical axis of the light before color separation, and the separated three primary colors is arranged, and the optical path of 2 light and the optical path of 1 light may be made into the symmetry, and they may be constituted so that 1 light in it may be separated in a part in the middle of the optical path of said 2 light and it

may be led on said optical axis.
[0026]
[Embodiment of the Invention]
Hereafter, the projection mold graphic display device of the operation gestalt of this invention is explained based on drawing 8 thru/or drawing 41 .
[0027]
(Operation gestalt 1)
Drawing 8 is the block diagram having shown the projection mold graphic display device of this operation gestalt. The light source 1 consists of an extra-high pressure mercury lamp, a metal halide lamp, a xenon lamp, etc. The condensing section 2 consists of the combination of the ellipse mirror reflected in response to the light by which outgoing radiation was carried out from the light source 1 or a parabolic mirror, and a condenser lens etc. Incidence of the light condensed in the condensing section 2 is carried out to an integrator (rod prism) 3, after it repeats a total reflection operation by the inner surface, it serves as the uniform surface light source, and outgoing radiation is carried out. And outgoing radiation of the light integrated in this way is carried out towards the lens array wheel (LAW) 4 which is an optical deflection means. the liquid crystal display panel top which mentions the optical exposure field on the lens array wheel 4 (magnitude) later — setting — the die length of the width, and abbreviation — it is the same and is considering as the magnitude from which the vertical die length is set to one third. In addition, if what has the taper configuration to which the field by the side of outgoing radiation becomes large rather than the field by the side of light-receiving as an integrator 3 is used, in outgoing radiation light, the distribution can be eased as much as possible.
[0028]
The lens array wheel 4 arranges two or more convex lens function parts in a disc configuration along with a circumferencial direction, and grows into it. A convex lens function part has the configuration which cut off the usual convex lens to fanning. This lens array wheel 4 makes the core of that disc configuration a center of rotation (revolving shaft), and by the motor 11, revolution actuation is carried out and it receives light from a direction parallel to said center of rotation (revolving shaft). thereby, two or more convex lens function parts pass cyclically the optical outgoing radiation side side of said integrator 3 — ******** — the periodic location of a convex lens function part — a variation rate will arise and an optical deflection will be performed periodically.
[0029]
The relay lens optical system 5 carries out incidence of the deflected light, and performs image transfer to color separation dichroic prism 6a in the image light product 6. It separates into R (red) light, G (green) light, and B (blue) light, and the light which carried out incidence to color separation dichroic prism 6a is led to liquid crystal display panel 7G liquid crystal display panel 7R for R, and for G, and liquid crystal display panel 7B for B, respectively. The scrolling exposure of the colored light (an exposure configuration is the shape of a strip of paper) led to each liquid crystal display panels 7R, 7G, and 7B is respectively carried out to the same timing on the panel concerned by the optical deflection by the aforementioned lens array wheel 4. The situation of this scrolling exposure is shown in drawing 10 thru/or drawing 16 . In addition, in these drawing 10 thru/or drawing 16 , the member of the shape of a lens located between the lens array wheel 4 and the liquid crystal display panel expresses the relay optical system 5, color separation dichroic prism 6a, etc.
[0030]
And each colored light which carried out incidence to each liquid crystal display panels 7R, 7G, and 7B is modulated in the state of the response (whenever [light transmission]) of the pixel on the panel concerned, and each color image light obtained by this modulation is compounded in color composition dichroic prism 6b, turns into color image light, and is projected on a screen 9 with the projection lens 8.
[0031]
Thus, it displays that only some periods in a frame period pay their attention to 1 pixel of the panel concerned when the illumination light of the shape of a strip of paper of each color scrolls

cyclically on the liquid crystal display panel 7, and as a result of the remaining periods' serving as black, an intermittent display is realized and the BURA ring at the time of displaying a dynamic image is improved. For example, when a strip-of-paper-like lighting field is set to one third of the whole panels (screen), as shown in drawing 17 (a), (b), and (c), it becomes intermittent display and equivalence of being non-display, during 2/tertiary stage by 1 / display during a tertiary stage.

[0032]

Next, the signal-processing system is explained. The panel actuator 15 drives each liquid crystal display panels 7R, 7G, and 7B based on the inputted video signal. That is, the component driver voltage which sets up whenever [light transmission / of each pixel of each liquid crystal display panel] based on a video signal is generated, and it gives each pixel. A synchronizing separator circuit 14 takes out a Vertical Synchronizing signal from a video signal, and gives it to the scrolling phase detecting element 12. The scrolling phase detecting element 12 detects phase contrast from the revolution period of the lens array wheel 4, and a vertical synchronization. The revolution period information on the lens array wheel 4 can be acquired by the configuration of a rotary encoder. The roll control section 13 which controls a revolution of a motor 11 controls to make the revolution period of the reception from the scrolling phase detecting element 12, and the lens array wheel 4 the signal which shows said phase contrast agree in a vertical synchronization. This content of control is shown in the flow chart of drawing 9 . The supply voltage (or a pulse number, pulse width, etc.) to a motor 11 is increased in order to raise rotational speed, if a revolution period is late for a vertical synchronization, and it decreases, and if in agreement, supply voltage (or a pulse number, pulse width, etc.) to a motor 11 will be left intact in order to make rotational speed low, if early.

[0033]

By the way, if the speed of response of a liquid crystal display panel is high-speed, it will be satisfactory, but since speed of response sufficient by the usual liquid crystal display panel is not obtained, it arises that the last response of a pixel is not completed during the exposure period of scrolling light. Unless the last response of a pixel is completed for it to come, the brightness value corresponding to image data will be acquired. Then, as shown in drawing 18 , the following frame data are written in a pixel immediately after exposure light scrolls. The example of a response of liquid crystal is shown in drawing 19 . As shown in drawing, in order that liquid crystal may react, ideally **2 It comes out and an optical exposure is made to be performed in the shown period. That is, as shown in drawing 20 , suppose that the timing of a liquid crystal response and a display (panel lighting) is set up. However, the liquid crystal panel used for the usual transparency mold liquid crystal projector cannot answer in a frame period, i.e., 17ms period. For this reason, even if it results in the write-in timing of a frame, the image of two frames ago will remain on a liquid crystal panel, and the double image will always be displayed through between the whole term. When the intermittent display by scrolling of exposure light is performed using such a panel, a result as which a double image is emphasized is brought and the impression that image quality improved is not acquired. For this reason, the response in a period is realized for 17ms using the technique of an overdrive in the data writing to a panel, and a double image is reduced. In a transparency mold liquid crystal projector, in making liquid crystal answer 100->200 for example, it writes in and suppose that it answers only to 180 within a period. However, what is necessary is just to use not 200 but 230 as an input value in this case, if it writes in when not 200 but 230 is inputted, for example, and it answers to 200 within a period. This situation is shown in drawing 21 . These are the examples of the panel which does not answer in 17ms. In drawing 21 (a), it turns out that the desired value is answered in the two-frame period. For this reason, the response of liquid crystal is made quick by emphasizing a changed part, as shown in drawing 21 (b). Consequently, liquid crystal answers within 17ms period, and it becomes possible to reduce a double image. Moreover, as shown in drawing 19 , as for exposure light, it is desirable to the period of frame writing to carry out abbreviation coincidence. It is because the double image has occurred at the period when the liquid crystal response is changing. In this case, it is possible to write in the period of exposure light, as shown in drawing 18 , and to double it just before a period. However, in this case, by the exposure start

point, it is a strong double image and a comparatively strong double image is recognized from the image displayed as a result. In this case, **2 of drawing 19 It is alike, and a comparatively good result is obtained by writing in and exceeding a period a little so that it may be shown. This is in the so-called condition of the thin Mie image an image comes to look on both sides of a motion part like a thin shadow. The result that this condition of subjectivity image quality is higher is obtained. Although the following examples explain as what doubles exposure light just before frame writing in order to avoid confusion, it writes not giving constraint at all to using the technique of raising subjective image quality in addition by not being limited to this exposure pattern and making a frame write-in period carry out abbreviation coincidence like the above-mentioned explanation.

[0034]

(Operation gestalt 2)

The configuration of the projection mold graphic display device of the operation gestalt 2 is shown in drawing 26 . And the projection mold graphic display device of this operation gestalt that can solve this trouble is explained, drawing 21 thru/or drawing 25 , and drawing 27 showing a trouble.

[0035]

The liquid crystal response condition by the operation gestalt 1 is typically shown in drawing 21 (a), and the liquid crystal response condition by the operation gestalt 2 is typically shown in drawing 21 (b).

[0036]

Here, even when it becomes an exponential change and an ideal optical exposure is performed, the response of liquid crystal has change of brightness during a display period, as shown in drawing 22 , and this will become a double image and it will be recognized. Then, the lighting timing to a liquid crystal pixel and the time of response flattening of the liquid crystal pixel concerned are made in agreement. As shown in drawing 23 , specifically, the writing to a liquid crystal pixel is performed by the integral multiple of a frame rate. For example, by the system driven by 60Hz, it writes in by 120Hz. And liquid crystal is made to answer to a desired value (desired value) within the first non-display 1 / 120-second period, and a liquid crystal response is set constant in 1 / 120-second period which is the remaining display periods.

[0037]

However, in 120Hz, since not almost all liquid crystal can answer, it performs overdrive control in the overdrive circuit 21 shown in drawing 26 so that liquid crystal may answer the value of hope. Overdrive control inputs a bigger change value than the value of hope into liquid crystal, and compensates delay. It writes in, even if it inputs the value for which it wishes, as shown in drawing 22 , and liquid crystal cannot answer within a period in many cases. For this reason, in making liquid crystal answer 100->200 for example, it writes in and suppose that it answers only to 180 within a period. However, what is necessary is just to input not 200 but 230, if it writes in noting that not 200 but 230 is inputted, for example, and it answers to 200 within a period. The value to which liquid crystal answers to a desired value within this write-in period is determined by the value of the current condition of liquid crystal, and a target condition, i.e., a front frame, and the value in the frame to write in. Moreover, since these values are not linearity, they are not a function and are determined in table. What is necessary is just to consider a table as the configuration which considers a pixel value (value in the frame to write in) to write in the pixel value (value in a front frame) of the condition before writing in, and a degree as an input (read-out address). And on this table, the input data value (excessive write-in value) to the panel needed since it becomes a pixel value (desired value) to write in after 17ms as output data is acquired. for this reason, the value which the pixel value of a frame tends to be memorized to a frame memory 22 (refer to drawing 26) before being alike, and it is going to write in with the value on a frame memory 22 to each pixel -- the address -- carrying out -- a table -- reference -- the pixel data (input data value to a panel) to write in are obtained from a table by things.

[0038]

Usually, the comparison of a drive and an overdrive is shown in drawing 24 . This drawing (a) is

the liquid crystal response of a drive usually, and this drawing (b) is the liquid crystal response of an overdrive. The relation between the response condition of this drawing (b) and a panel lighting period is shown in drawing 25 . A panel lighting period and the time of response flattening of the liquid crystal pixel concerned will be in agreement, brightness change within a panel lighting period is suppressed, and duplex image prevention is achieved so that this drawing 25 may show.

[0039]
Drawing 27 is drawing which expressed the write-in timing of the overdrive circuit 21 on the display device. Although the following frame data are written in from the part (part where the lighting field passed away) which the display ended, since a speed of response response which was mentioned above is required for this, overdrive writing will be performed. And by writing in the value of normal, before entering at a display period, the liquid crystal response in subsequent display periods (remainder of an one-frame period) is held in the flat condition.
[0040]
(Operation gestalt 3)
The configuration of the projection mold graphic display device of the operation gestalt 3 is shown in drawing 30 . And this operation gestalt is explained, the trouble in the configuration of the above-mentioned operation gestalt being shown based on drawing 28 and drawing 29 .
[0041]
It is the rotational accuracy (rotational accuracy of a motor 11) of the ** lens array wheel 3 made into a problem. Although it is satisfactory if a lighting location is surely in agreement with the timing of frame writing, the rotational speed of the usual motor 11 is not stabilized thoroughly. For this reason, the exposure period (display period) of light will get mixed up in a frame period. This phenomenon is divided into two conditions (refer to drawing 19). First, an ideal condition is in the condition in which a display period carries out abbreviation agreement at the phase of a vertical synchronization, as shown in drawing 28 (a). On the other hand, a double image will be perceived when a display period shifts greatly to the phase of a vertical synchronization, as shown in drawing 28 (b). In this phase, since liquid crystal is answering, the double image as which the before frame image and the written-in frame image were displayed is displayed on the liquid crystal panel. Consequently, the image perceived also turns into a double image and is recognized as big image quality degradation. By drawing 28 , it writes in with a frame rate and the case where a rate is the same is shown. In addition, as shown in drawing 25 , when bringing forward and carrying out flattening of the pixel response, the gap with a frame period and the deflection period by the optical deflection means may be made to carry out amendment control of the deflection period so that it may be generated in the side in which the optical exposure period to a pixel is rash to the phase of a frame period.
[0042]
With this operation gestalt 3, solution by the overdrive method as shown in drawing 28 (c) is indicated to the problem of the above-mentioned double image. An overdrive here is in making a response meet the deadline so that a double image may disappear in the exposure period (display period) of light. That is, the value exceeded rather than the input pixel value is inputted as a pixel value so that a liquid crystal response may meet the deadline in the part of the exposure period (display period) of light (it emphasizes). For example, 30 is inputted, when changing to 50-100 and changing 130 to 50 from 100. These values are determined by a liquid crystal speed of response and the timing currently irradiated, and an input value is emphasized that a double image disappears to the irradiated timing (extent of phase contrast with a vertical synchronization).
[0043]
By the overdrive here, phase contrast will start the input of a table further. The desired value in this case should be determined that the area formed by the pattern of drawing 28 (c) will become the same as the area in the pattern of drawing 28 (a). For this reason, a actual write-in value is determined by the value of a front frame, the value (desired value) of the pixel data which it is going to write in, and phase contrast.
[0044]

In this case, the thing whose caution is the need is the difference with the usual overdrive and the overdrive in this operation gestalt 3. In order to write in so that the inputted pixel value may turn into a policy objective value by the usual overdrive, the final value of the frame period of a liquid crystal response is the same as that of input pixel data. Therefore, what is necessary is to compare said input pixel data and input pixel data of the following frame, in writing in the following frame, and just to determine a write-in value. On the other hand, the overdrive which considered the phase contrast of this operation gestalt 3 will change extent of an overdrive corresponding to extent of phase contrast with a vertical synchronization, and also changes the final value of a frame period by this. Therefore, the final value of a frame period does not become the same as that of input pixel data. Therefore, in writing in the following frame, it writes in the data equivalent to the final value of a frame period from the overdrive circuit 31 side to the frame memory 32, and the data equivalent to the final value of this frame period will be compared with the input pixel data of the following frame, and a write-in value will be determined.

[0045]
Although it becomes a repeat, the difference with the usual overdrive and the overdrive which considered phase contrast is described further below. In drawing 29 , the dotted line shows the liquid crystal response at the time of using the usual overdrive. A is a pixel value (input pixel data of a frame), and liquid crystal shows a response like a continuous line by inputting a bigger value than this pixel value A into a liquid crystal display panel. What is necessary is just to perform the overdrive in the following frame in the usual overdrive based on the pixel value A, since liquid crystal has answered to a pixel value, i.e., target level, to the timing of a change of a frame. But, by the overdrive which considered phase contrast, in order to input the area of the period when light is irradiated actually as desired value, the final value of a frame period becomes like C. For this reason, the overdrive of the following frame will be performed on the basis of the value of this C. The overdrive circuit 31 carries in the interior the table on which the final value (C) of a frame period is given as resemble the input pixel data (A) of a frame, and the actual write-in value (applied voltage B) by the overdrive which considered phase contrast, and gives the final value (C) of a frame period to a frame memory 32. And in the following frame, the input pixel data of the frame and the phase contrast information received from the final value (C) and the scrolling phase detecting element 12 of said frame period received from the frame memory 32 will perform an overdrive.

[0046]
(Operation gestalt 4)
The projection mold graphic display device of the operation gestalt 4 is explained based on drawing 31 thru/or drawing 33 . With this operation gestalt, like the operation gestalt 3, although the problem of a double image is solved, the technique of being different in the operation gestalt 3 is proposed.

[0047]
The projection mold graphic display device of this operation gestalt is equipped with the memory 41 and the read-out timing-control circuit 42 which store image data as shown in drawing 31 . Image data (frame) are memorized by memory 41, and the image data of one frame ago are given to the read-out timing-control circuit 42 from the frame supplied actually. Although the read-out timing-control circuit 42 reads pixel data from memory 41 one by one and supplies this to the panel actuator 15, it adjusts the supply timing of said pixel data for phase contrast information according to reception and this topology (scrolling gap) from the scrolling phase detecting element 12. If a phase shift as this shows to (b) in drawing 33 from the condition without a phase shift shown in (a) in drawing 33 arises, this will appear as an output (topology) of a sensor (scrolling phase detecting element 12), and the write-in location (supply timing to a panel) of data will be shifted to an early period by control of the read-out timing-control circuit 42. By this, as shown in drawing 32 (c), according to a gap of a vertical synchronization and a lighting pattern, the timing which reads data, and the timing written in a liquid crystal panel will be adjusted, and display brightness will be guaranteed.

[0048]

In addition, it can change to a lens array wheel (LAW), and scrolling disc 4A can be used. This scrolling disc 4A prepares a transparence part in a part, and is equivalent to what used the remainder as the mirror. This scrolling disc 4A is shown in drawing 34 . In drawing 34 , 4Aa is a transparence part and 4Ab is a mirror part. By this, as shown in drawing 35 , only the period of the transparency part of a scrolling disc is projected on the white light by the liquid crystal display panel, and the remainder will return to the rod integrator 3 interior, and will be reflected and reused.

[0049]

Monochrome wheel 4B is shown in drawing 36 as an optical deflection means. Integrator 3' which prepared the include angle in the part which carries out incidence of the light is constituted, and cylinder-like monochrome wheel 4B is formed in the perimeter. This wheel 4B has the revolution composition of reflecting transparency and the remainder in part for every frame period, in the outgoing radiation light of integrator 3', and obtains scrolling light on a liquid crystal panel by rotating this wheel 4B.

[0050]

Although the usual rod integrator (3) is carrying out the linear configuration, if it remains as it is, light cannot be irradiated to a peripheral surface side in monochrome wheel 4B. For this reason, incidence of the light is carried out using rod integrator 3' bent on the way. The black part of a wheel shows the reflector to the interior, and the transparency side where a white part is transparent. The light irradiated by the black reflector returns to the interior, and is reused. Since the transparency side serves as some (drawing about 1/3) fields of a screen, the light condensed by this field will be irradiated by the liquid crystal panel, and exposure light will scroll by rotating this monochrome wheel 4B.

[0051]

With the configuration shown in drawing 36 , although the optical incidence side of rod integrator 3' is bent, as shown in drawing 37 , monochrome wheel 4C of a minor diameter can also be used using rod integrator 3″ which bent the optical outgoing radiation side. In this case, although structure becomes long in a longitudinal direction, since monochrome wheel 4C of a minor diameter can be used, the motor of a high-speed revolution can be used. Generally effectiveness of a motor is high also from the field which it is easy to control the direction of a high-speed revolution, and prevents generating of a double image.

[0052]

Moreover, as shown in drawing 38 , scroll prism 4D can be used. A cube configuration is accomplished, a revolving shaft is set as a space perpendicular direction in drawing, to the optical outgoing radiation side of the rod integrator 3, four fields change an include angle periodically and meet, and this scroll prism 4D is constituted so that outgoing radiation light may scroll in an optical refraction operation.

[0053]

In addition, with the operation gestalt explained above, although the liquid crystal display panel of a transparency mold was used, it cannot restrict to this and the device which drives respectively the minute mirror arranged the shape of a liquid crystal display panel or a matrix of a reflective mold based on pixel data can be used.

[0054]

Scrolling disc 44A is shown in drawing 39 . The thick wire rectangular-head frame of drawing shows the primary image formation field to which the light from the light source is led. Moreover, in drawing, hatching shows the light reflex field of scrolling disc 44A. The A-A cross section in scrolling disc 44A is shown in drawing 40 . This drawing (a), (b), and (c) show signs that a light transmission condition changes because scrolling disc 44A rotates. To the optical axis, 45 degrees scrolling disc 44A inclines, and is arranged. And scrolling disc 44A was made to meet in the location which does not check an introductory light from the light source, and the auxiliary mirror 45 is formed. The light reflected in the light reflex field of scrolling disc 44A is led to the auxiliary mirror 45, and the light reflected by this auxiliary mirror 45 penetrates the light transmission field of scrolling disc 44A. Since the light from the light source led to the primary image formation field of scrolling disc 44A will be led to a liquid crystal display panel by a

transparency operation of the light transmission field of scrolling disc 44A, and the above-mentioned reflex action, without being made useless, improvement in brightness of a display image can be aimed at.

[0055]

Although drawing 39 and scrolling disc 44A shown in 40 formed the light reflex field in one side of a transparence disc, a light reflex field may be formed in both sides of a transparence disc. By using both sides of a transparence disc for a light reflex, only one side is released from the constraint in the case of considering as a light reflex side, and can attain design easy-ization of a scrolling disc etc.

[0056]

Moreover, the exposure optical system 100 is shown in drawing 41 . The light source 101 consists of a metal halide lamp, a xenon lamp, etc., and the exposure light turns into parallel light, outgoing radiation is carried out by the parabola reflector, and it is led to the integrator lens 102.

[0057]

The integrator lens 102 consists of lens groups of a couple, and leads the light to which outgoing radiation of each lens pair was carried out from the light source 101 to the optical incidence field of the scrolling optical system 105. The primary image formation field (lighting field for scrolling) mentioned above is made perpendicularly short to liquid crystal display panel size, and each lens of the integrator lens 102 is made perpendicularly short corresponding to this. The scrolling optical system 105 can be constituted using the lens array wheel 4, the scrolling discs 4A and 44A, etc. which were mentioned above. After the light which passed through the integrator lens 102 passes through a condenser lens 103, a mirror 104, and scrolling optical-system 105 grade, it is led to the dichroic mirrors 106a and 106b by which cross arrangement was carried out.

[0058]

Dichroic mirror 106a reflects a part for red Mitsunari, and a green light component, and a blue glow component is made to penetrate. Dichroic mirror 106a reflects a blue glow component, and a part for red Mitsunari and a green light component are made to penetrate. Dichroic mirrors 106a and 106b are arranged on the optical axis of the light before color separation (light on a primary image formation field). Moreover, color composition dichroic prism 6b is arranged on this optical axis. Centering on said optical axis, it considers as the symmetry, the green light in it is separated by the dichroic mirror 110 in a part in the middle of the optical path of said 2 light, and the optical path of 2 light (red light and green light) and the optical path of 1 light (blue glow) are drawn on said optical axis by the mirror 111. this should pass a mirror 109 and a mirror 108 from dichroic mirror 106a — pass a dichroic mirror 110 and a mirror 111 from dichroic mirror 106a with the optical path length to liquid crystal display panel 7R for red — pass a mirror 112 and a mirror 113 from dichroic mirror 106b with the optical path length to liquid crystal display panel 7G for green — the optical path length to liquid crystal display panel 7G for blue — mutual — etc. — it spreads — it has become.

[0059]

Although arranging relay optical system on the optical path of blue glow is performed, for example with the general configuration using the color composition optical system by the dichroic prism, when such optical system is diverted as it was, it arises that the direction of scrolling of exposure blue glow becomes other scrolling directions and reverse of colored light according to relay optical system. Like ****, relay optical system can be made unnecessary, using the configuration of the general color composition optical system by the dichroic prism by having made equal the optical path length to the liquid crystal display panel of each color, after carrying out color separation, and the outstanding effectiveness of the cutback of optical members will be acquired by consistency reservation and coincidence of the scrolling direction.

[0060]

In addition, it can consider as the configuration which separates into red light and cyanogen colored light, and separates green light on the optical path of cyanogen colored light, and the optical path length of each colored light can also be made equal like the above.

[Translation done.]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the explanatory view having shown the optical output property over the input signal of CRT and a hold mold display device.
[Drawing 2] It is the explanatory view having shown the display image and check-by-looking property in CRT.
[Drawing 3] It is the explanatory view having shown the display image and check-by-looking property in a hold mold display device.
[Drawing 4] This drawing (a) and (b) are the explanatory views explaining generating of the duplex image in a hold mold display device.
[Drawing 5] This drawing (a) and (b) are the explanatory views explaining generating of the duplex image in a hold mold display device.
[Drawing 6] This drawing (a) and (b) are the explanatory views explaining a duplex image not occurring in CRT.
[Drawing 7] This drawing (a) and (b) are the explanatory views having shown that a duplex image was mitigated by performing intermittent illumination in a hold mold display device.
[Drawing 8] It is the block diagram having shown the projection mold graphic display device of the operation gestalt 1 of this invention.
[Drawing 9] It is the flow chart which showed that motor control was performed with an image synchronizing signal and the output of a scrolling phase detector.
[Drawing 10] It is the explanatory view having shown the situation of scrolling of the illumination light to a liquid crystal panel top.
[Drawing 11] It is the explanatory view having shown the situation of scrolling of the illumination light to a liquid crystal panel top.
[Drawing 12] It is the explanatory view having shown the situation of scrolling of the illumination light to a liquid crystal panel top.
[Drawing 13] It is the explanatory view having shown the situation of scrolling of the illumination light to a liquid crystal panel top.
[Drawing 14] It is the explanatory view having shown the situation of scrolling of the illumination light to a liquid crystal panel top.
[Drawing 15] It is the explanatory view having shown the situation of scrolling of the illumination light to a liquid crystal panel top.
[Drawing 16] It is the explanatory view having shown the situation of scrolling of the illumination light to a liquid crystal panel top.
[Drawing 17] This drawing (a), (b), and (c) are the explanatory views having shown the relation between a liquid crystal response and the liquid crystal brightness in the intermittent illumination by scrolling.
[Drawing 18] It is the explanatory view having shown the relation between the situation of scrolling on a screen, and a pixel data store.
[Drawing 19] It is the explanatory view having shown the relation of the display image quality by a liquid crystal response and the lighting period.
[Drawing 20] It is the explanatory view having shown the relation between a liquid crystal

response and a lighting period.
[Drawing 21] This drawing (a) is an explanatory view having shown the case (liquid crystal response flattening) where the liquid crystal response in the case of performing a data store by **** of a synchronization was shown, this drawing (b) performed an overdrive in the first half in this store, and the data store of desired value was performed in the second half.
[Drawing 22] It is the explanatory view having shown the relation between a liquid crystal response and a lighting period.
[Drawing 23] It is the explanatory view having shown the relation between a liquid crystal response and a lighting period.
[Drawing 24] This drawing (a) shows the usual store and this drawing (b) is an explanatory view having shown liquid crystal response flattening by the overdrive.
[Drawing 25] It is the explanatory view having shown doubling lighting timing (display) at the time of liquid crystal response flattening by the overdrive.
[Drawing 26] It is the block diagram having shown the projection mold graphic display device of the 2nd operation gestalt of this invention.
[Drawing 27] It is the explanatory view having shown the relation between the situation of scrolling on a screen, and a pixel data store.
[Drawing 28] This drawing (a), (b), and (c) are the explanatory views having shown that change arises in pixel brightness by gap of the lighting period within a frame period, and its solution (the overdrive technique).
[Drawing 29] It is the explanatory view having shown how to solve that change arises in pixel brightness by gap of the lighting period within a frame period.
[Drawing 30] It is the block diagram having shown the projection mold graphic display device of the 3rd operation gestalt of this invention.
[Drawing 31] It is the block diagram having shown the projection mold graphic display device of the 4th operation gestalt of this invention.
[Drawing 32] This drawing (a), (b), and (c) are the explanatory views having shown that change arises in pixel brightness by gap of the lighting period within a frame period, and its solution (frame read-out control).
[Drawing 33] This drawing (a) shows the usual frame read-out control, and this drawing (b) is an explanatory view having shown frame read-out control of the above-mentioned solution.
[Drawing 34] It is the explanatory view having shown other examples of an optical deflection means.
[Drawing 35] It is the explanatory view having shown the example of a configuration using the optical deflection means of drawing 34 .
[Drawing 36] It is the explanatory view having shown other examples of an optical deflection means, and this drawing (a) is a side elevation and this drawing (b) is a front view.
[Drawing 37] It is the explanatory view having shown other examples of an optical deflection means, and this drawing (a) is a side elevation and this drawing (b) is a front view.
[Drawing 38] It is the explanatory view having shown other examples of an optical deflection means.
[Drawing 39] It is the explanatory view having shown the scrolling disc which are other examples of an optical deflection means.
[Drawing 40] It is drawing having shown the A-A cross section in the scrolling disc of drawing 39 , and this drawing (a), (b), and (c) show signs that a light transmission condition changes because a scrolling disc rotates, respectively.
[Drawing 41] It is the explanatory view having shown exposure optical system.
[Description of Notations]
1 Light Source
2 Condensing Section
3 Integrator
4 Lens Array Wheel
4A Scrolling disc
4B Monochrome wheel

4C Monochrome wheel
4D Scroll prism
5 Relay Lens
6 Image Light Product
7R, 7G, and 7B Liquid crystal display panel
11 Stepping Motor
12 Scrolling Phase Detecting Element
13 Roll Control Section
14 Synchronizing Separation Section
15 Panel Actuator
21 Overdrive Circuit
22 Frame Memory
31 Overdrive Circuit
32 Frame Memory
41 Memory 42 Read-out Timing-Control Section
44A Scrolling disc
45 Auxiliary Mirror
100 Exposure Optical System
101 Light Source
102 Integrator Lens
105 Scrolling Optical System
106a dichroic mirror
106b dichroic mirror
110 Dichroic Mirror

[Translation done.]

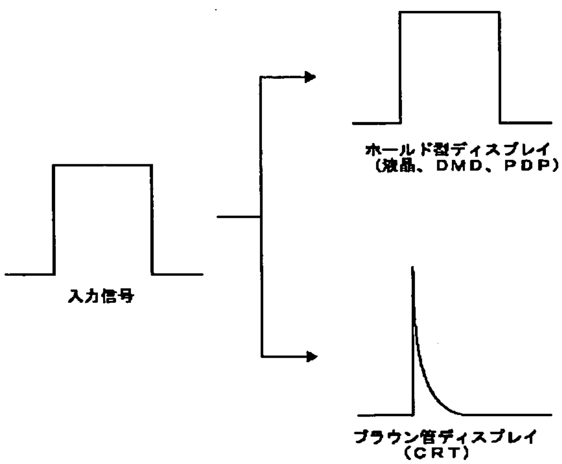
* NOTICES *

Japan Patent Office is not responsible for any damages caused by the use of this translation.

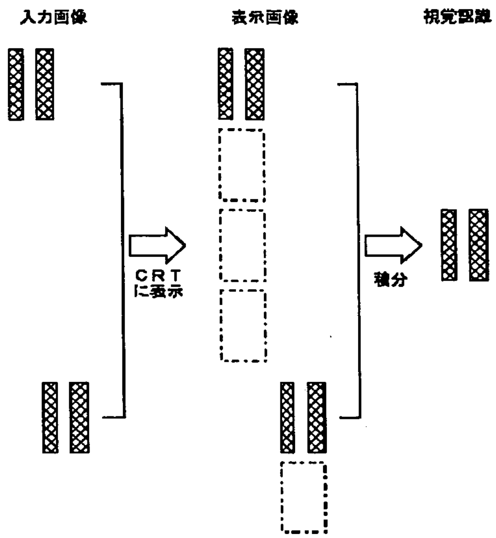
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

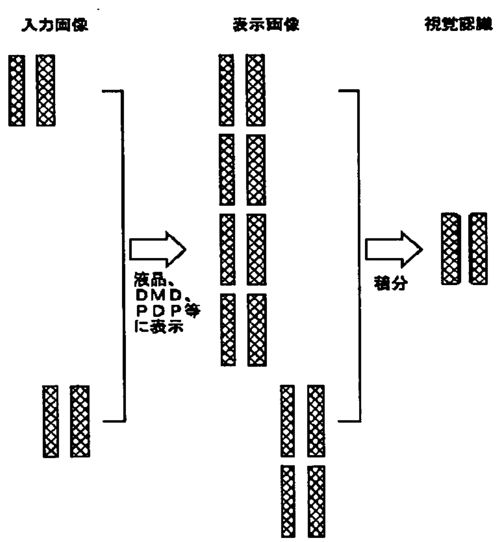
[Drawing 1]



[Drawing 2]



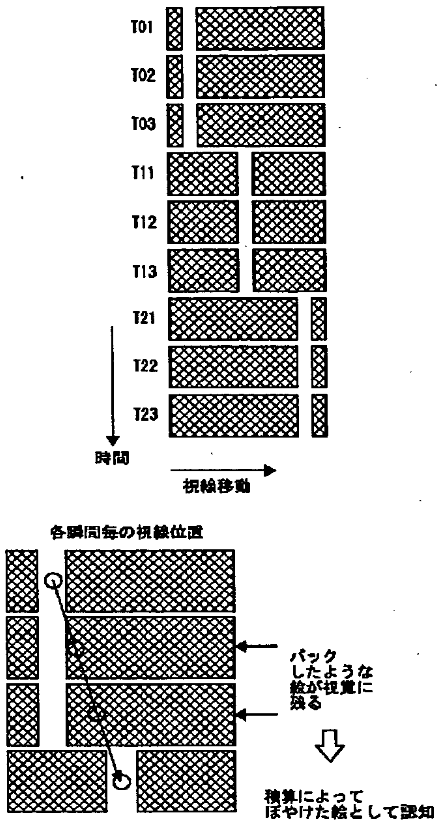
[Drawing 3]



[Drawing 4]

(a)

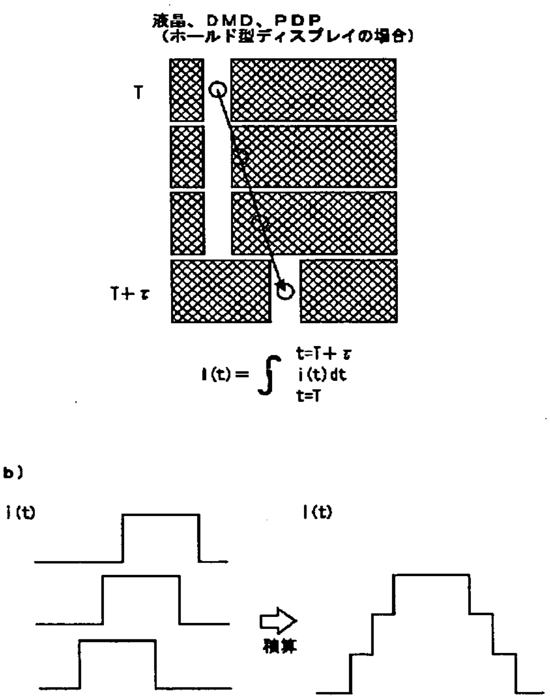
(b)



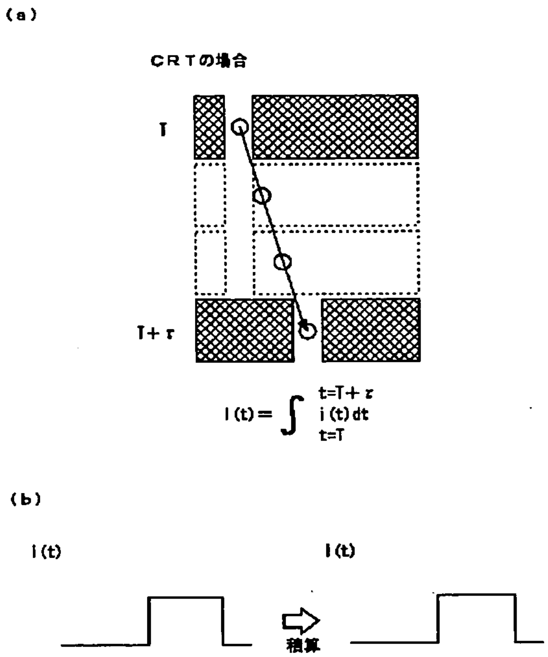
[Drawing 5]

(a)

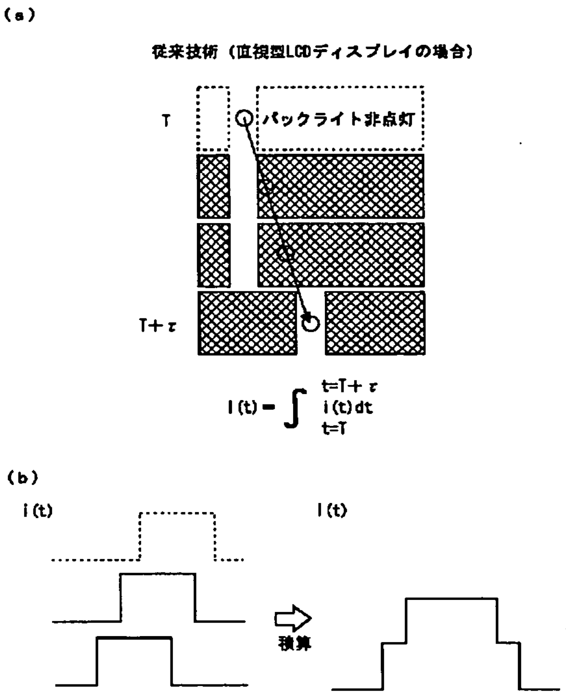
(b)



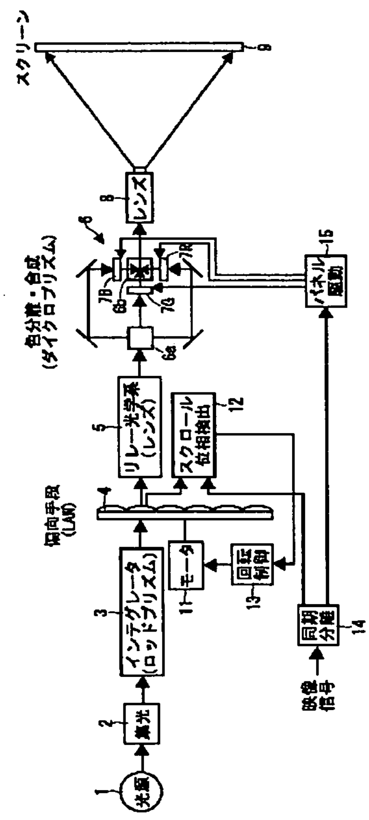
[Drawing 6]



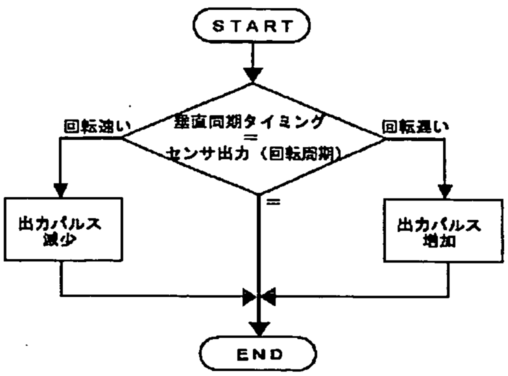
[Drawing 7]


(a)
従来技術（直視型LCDディスプレイの場合）
T
バックライト非点灯
T+τ
I(t) = ∫ i(t)dt
t=T+τ
t=T
(b)
i(t)
I(t)
積算

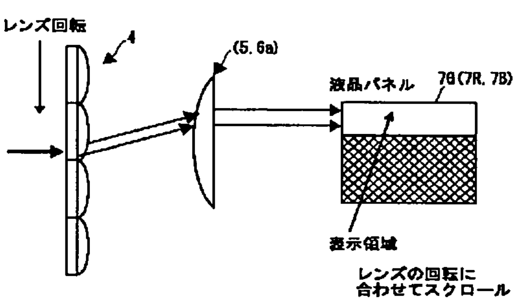
[Drawing 8]


スクリーン
レンズ
色分離・合成
(ダイクロプリズム)
パネル駆動
リレー光学系
(レンズ)
スクロール
位相検出
偏向手段
インテグレータ
(ロッドプリズム)
モータ
回転制御
同期分離
映像信号
集光
光源

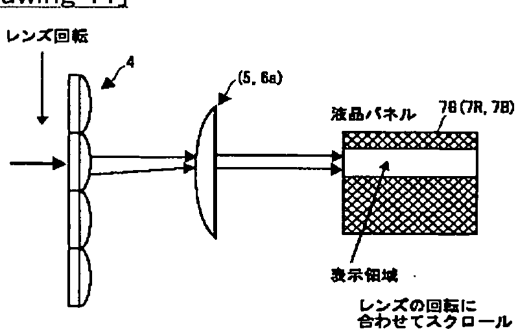
[Drawing 9]



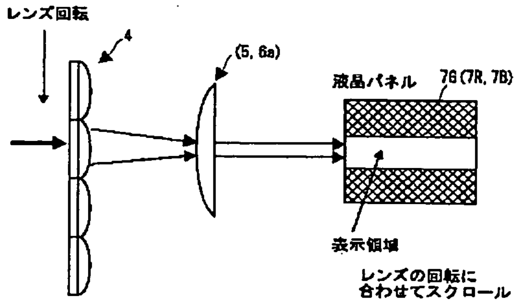
[Drawing 10]



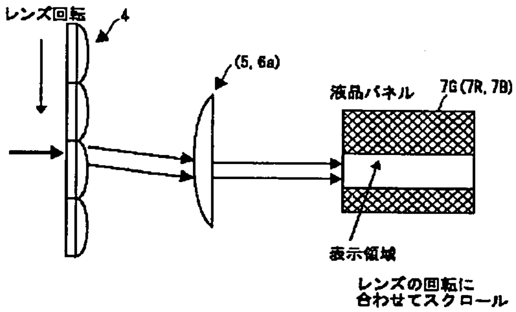
[Drawing 11]



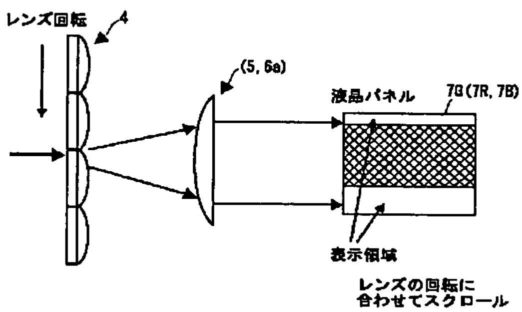
[Drawing 12]



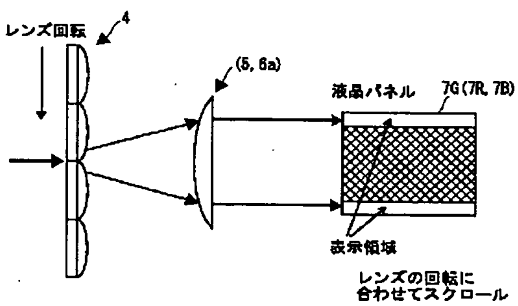
[Drawing 13]



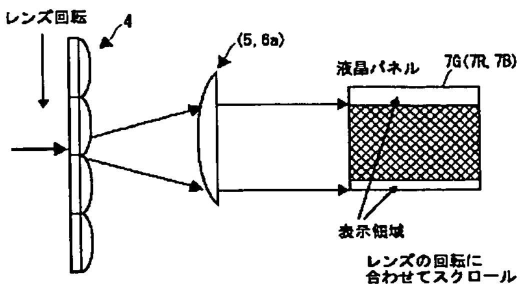
[Drawing 14]



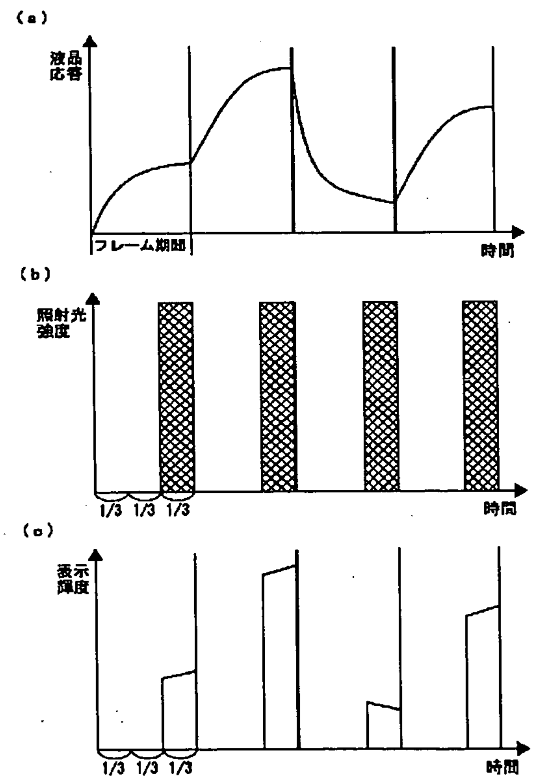
[Drawing 15]



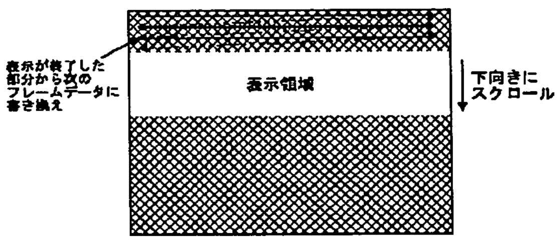
[Drawing 16]



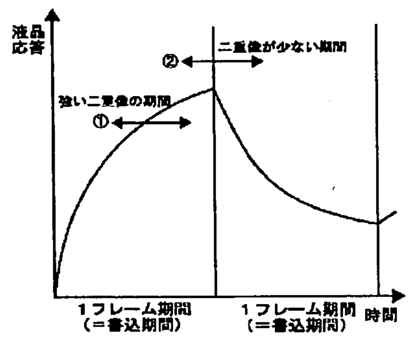
[Drawing 17]



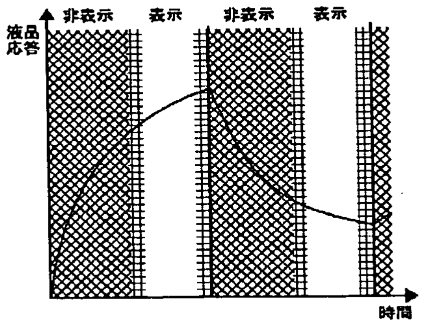
[Drawing 18]



[Drawing 19]

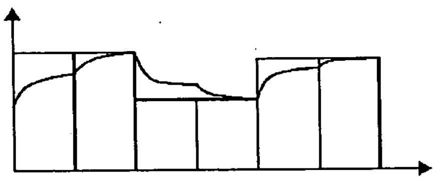


[Drawing 20]

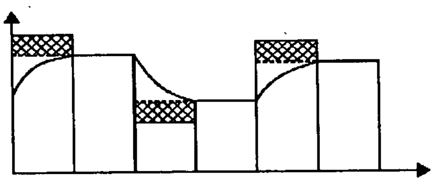


[Drawing 21]

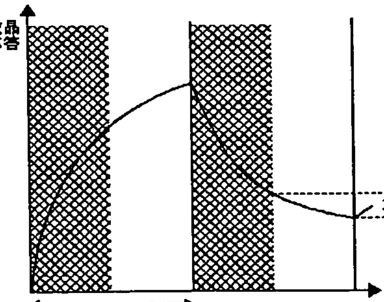
（a）



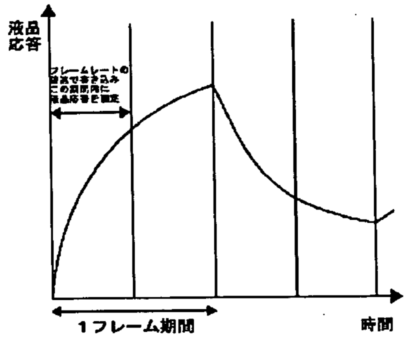
（b）



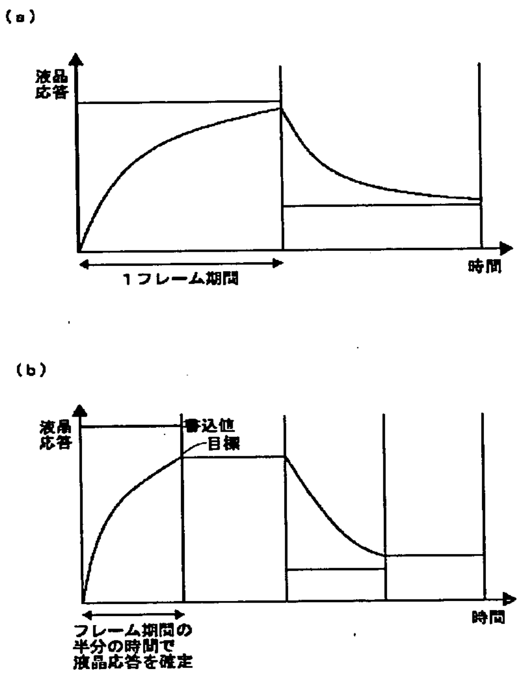
[Drawing 22]



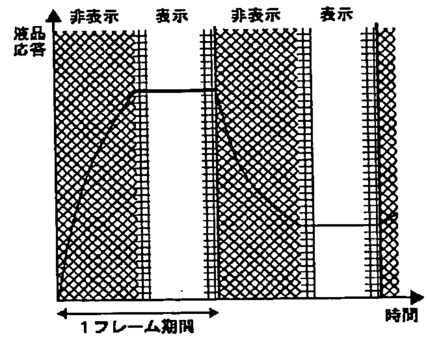
[Drawing 23]



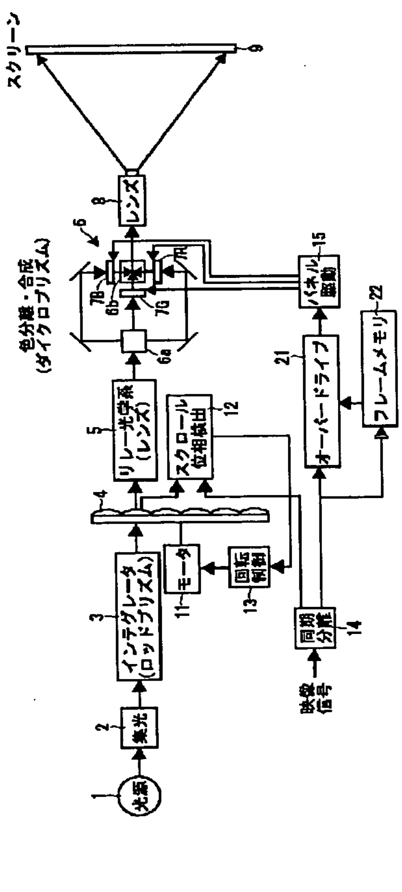
[Drawing 24]



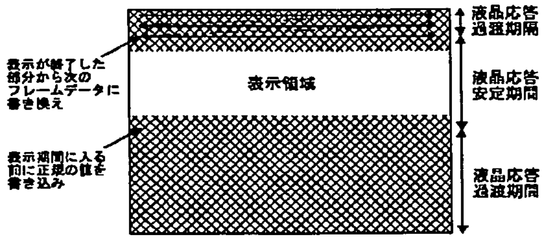
[Drawing 25]


非表示
表示
非表示
表示
液晶応答
1フレーム期間
時間

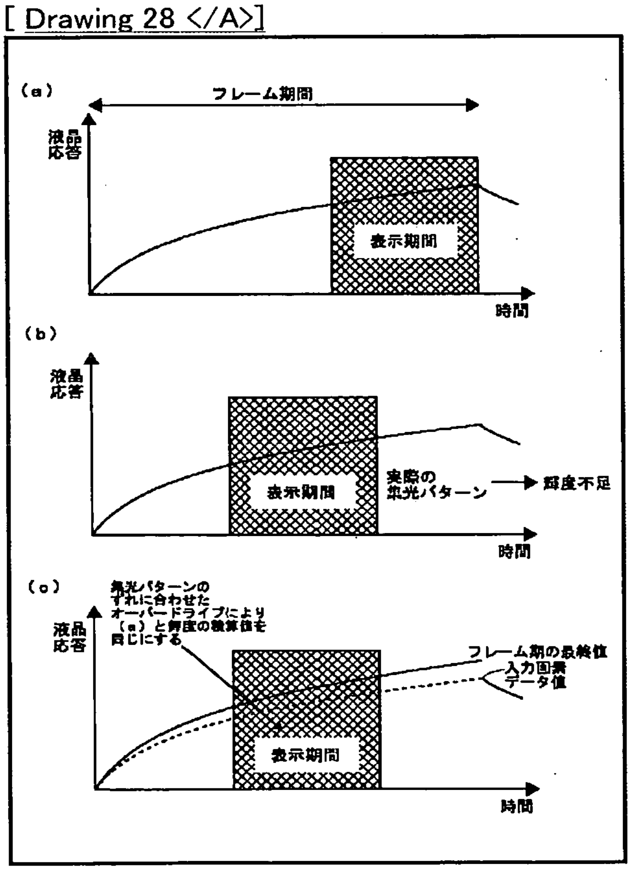
[Drawing 26]


スクリーン
レンズ
色分離・合成
(ダイクロプリズム)
リレー光学系
(レンズ)
スクロール
位相検出
パネル
駆動
オーバードライブ
フレームメモリ
インテグレータ
(ロッドプリズム)
モータ
回転
制御
同期
分離
映像
信号
集光
光源

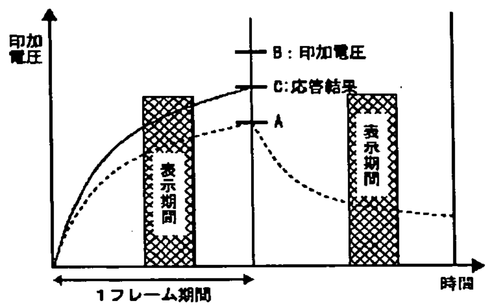
[Drawing 27]



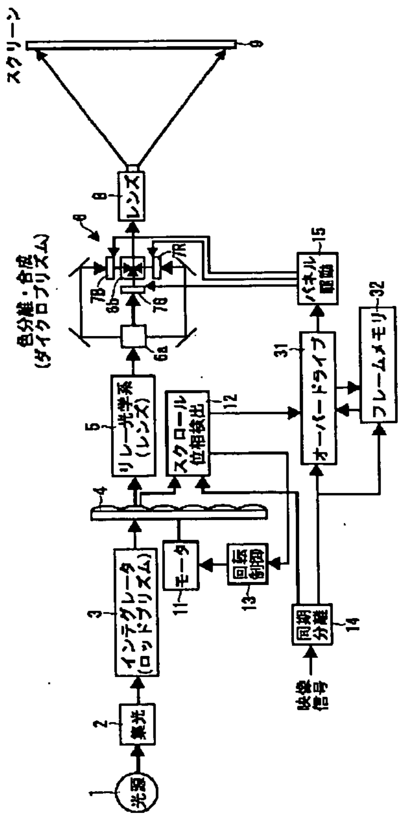
[Drawing 28 </A>]



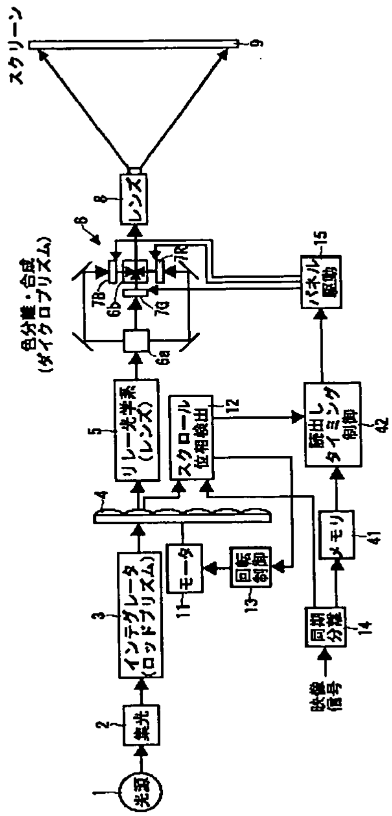
[Drawing 29]



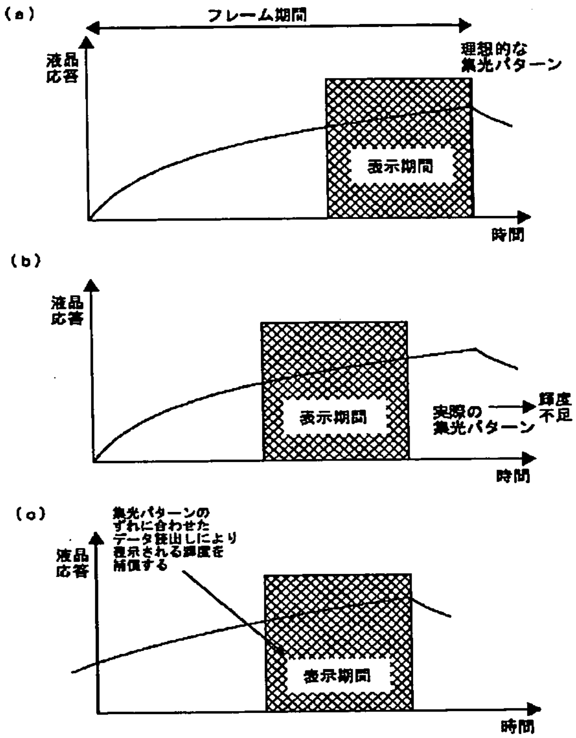
[Drawing 30]



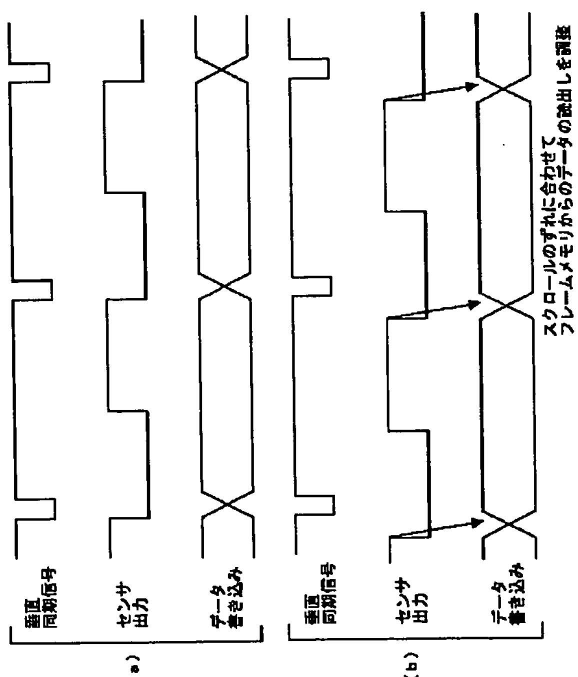
[Drawing 31]



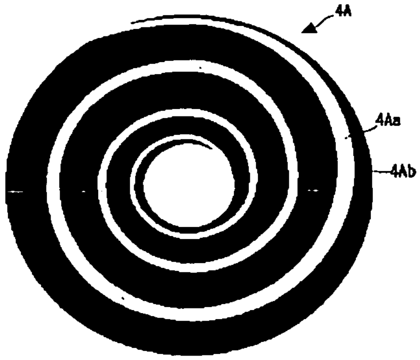
[Drawing 32]


(a)
フレーム期間
液晶応答
理想的な集光パターン
表示期間
時間
(b)
液晶応答
表示期間
実際の集光パターン
輝度不足
時間
(c)
集光パターンのずれに合わせたデータ読出しにより表示される輝度を補償する
液晶応答
表示期間
時間

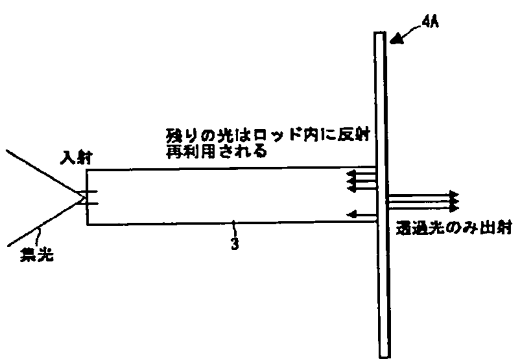
[Drawing 33]


垂直同期信号
センサ出力
データ書き込み
(a)
垂直同期信号
センサ出力
データ書き込み
(b)
スクロールのずれに合わせてフレームメモリからのデータの読出しを調整

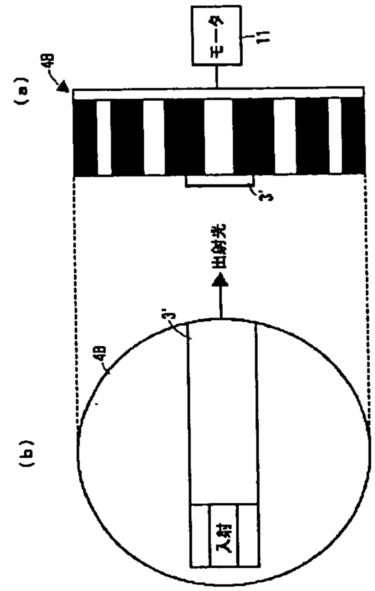
[Drawing 34]



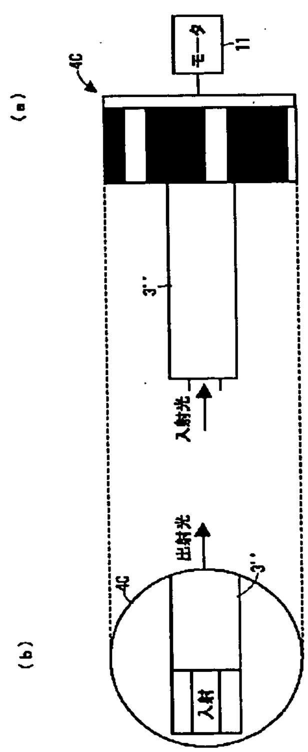
[Drawing 35]



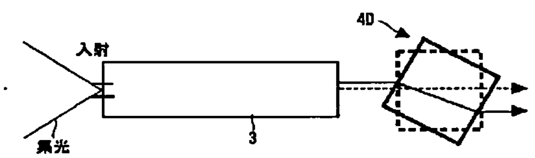
[Drawing 36]



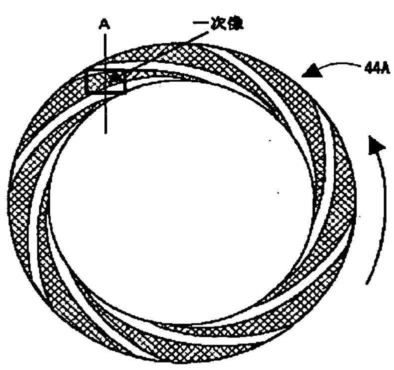
[Drawing 37]



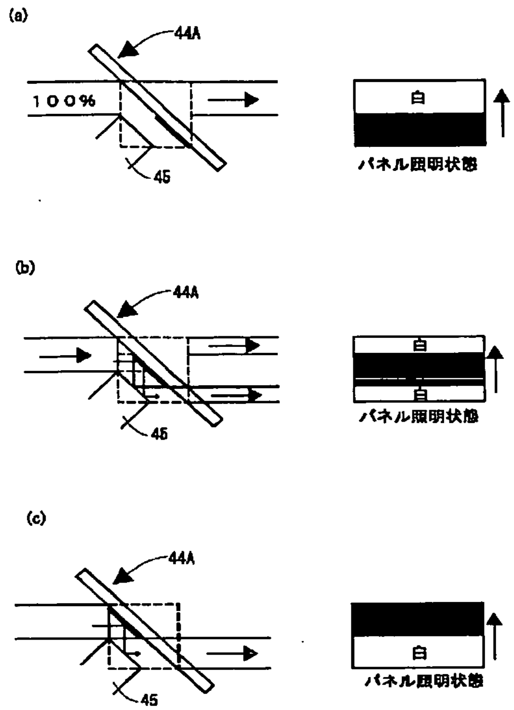
[Drawing 38]



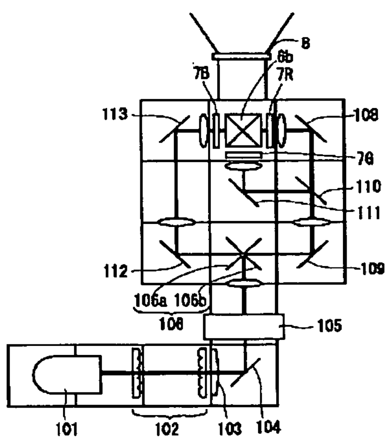
[Drawing 39]



[Drawing 40]



[Drawing 41]



[Translation done.]

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特開2004-4463
(P2004-4463A)
(43)公開日　平成16年1月8日(2004.1.8)

(51) Int.Cl.[7]	F I		テーマコード（参考）
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G03B 21/00	G03B 21/00	E	5C060
H04N 9/31	G03B 21/00	F	
	H04N 9/31	Z	

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(22) 出願日　平成14年10月8日 (2002.10.8)
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(32) 優先日　平成14年3月28日 (2002.3.28)
(33) 優先権主張国　日本国 (JP)

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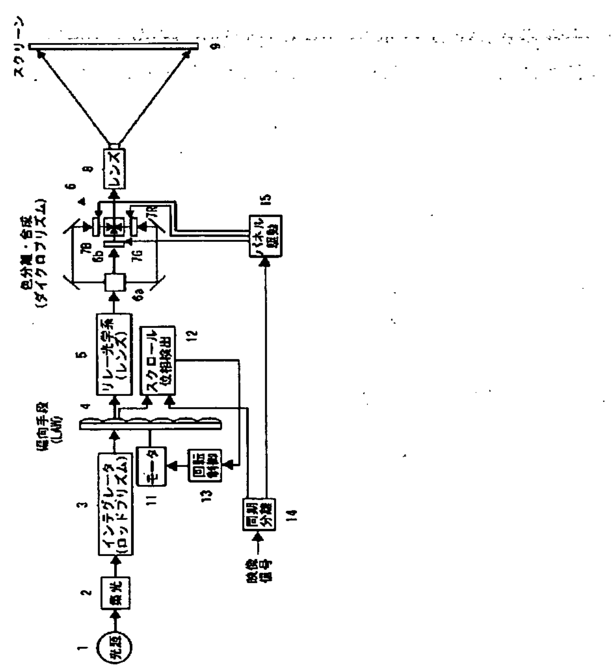
大阪府守口市京阪本通2丁目5番5号
三洋電機株式会社内
(72) 発明者　飯沼　俊哉
大阪府守口市京阪本通2丁目5番5号
三洋電機株式会社内

最終頁に続く

(54)【発明の名称】投写型映像表示装置及び照明装置

(57)【要約】
【目的】小型化可能な光学系にてホールド型表示素子上に光スクロールを行ない、ホールドブラーリングと呼ばれる動画像表示の際の画質劣化を改善できる投写型映像表示装置を提供する。
【構成】レンズアレイホイール４は、その回転軸に平行な方向から照射された光を受けて当該光に循環的な偏向を生じさせる。各液晶表示パネル７R，７G，７B上では循環的に光がスクロールし、実質的な間欠照明の効果が生じ、ホールドブラーリングが軽減される。パネル駆動部１５は、各液晶表示パネル７R，７G，７B上で照明領域が通り過ぎる位置に存在する画素に対して次のフレームの画素駆動信号を供給し始める。
【選択図】　図８



【特許請求の範囲】
【請求項１】
照射された光を受けて透過ないしは反射させる際に当該光に循環的な偏向を生じさせる回転駆動型の光偏向手段と、光偏向手段からの光を３原色に分離して３つのホールド型表示素子に各々導く色分離手段と、各ホールド型表示素子を経て得られる各色映像光を合成して投写する投写手段と、各ホールド型表示素子に画素駆動信号を与える素子駆動手段とを備え、各ホールド型表示素子上で当該素子よりも小さな面積で集光される各色光が循環的にスクロールされるように構成されたことを特徴とする投写型映像表示装置。
【請求項２】
請求項１に記載の投写型映像表示装置において、前記素子駆動手段は、各ホールド型表示素子上で照明領域が通り過ぎる位置に存在する画素に対して次のフレームの画素駆動信号を供給し始めるように構成されたことを特徴とする投写型映像表示装置。
【請求項３】
請求項２に記載の投写型映像表示装置において、画素駆動信号の供給をフレームレートのＮ倍（Ｎは２以上の整数）で行い、画素への照明タイミングと当該画素の応答平坦化時とを一致させるように構成されたことを特徴とする投写型映像表示装置。
【請求項４】
請求項３に記載の投写型映像表示装置において、画素の必要応答値が得られる画素駆動信号よりも変化を強調した画素駆動信号を供給して遅れ補償を行なうように構成されたことを特徴とする投写型映像表示装置。
【請求項５】
請求項４に記載の投写型映像表示装置において、前フレームの最終画素値と今回の画素値とによって前記変化を強調した画素駆動信号のデータが得られるテーブルを備えたことを特徴とする投写型映像表示装置。
【請求項６】
請求項１乃至請求項５のいずれかに記載の投写型映像表示装置において、フレーム周期と光偏向手段による偏向周期とのずれを検出し、このずれが解消されるように又はずれが一定に生じるように偏向周期を補正制御する制御手段を備えたことを特徴とする投写型映像表示装置。
【請求項７】
請求項６に記載の投写型映像表示装置において、前記ずれを生じた際の画素の応答と当該画素への光照射期間とで定まる画素の輝度値を、ずれを生じない場合の予定輝度値に近づける制御を行なうように構成されたことを特徴とする投写型映像表示装置。
【請求項８】
請求項７に記載の投写型映像表示装置において、前記ずれに応じて、画素応答の目標値よりも変化を強調した値を設定して画素駆動信号を供給することを特徴とする投写型映像表示装置。
【請求項９】
請求項７に記載の投写型映像表示装置において、前記ずれに応じて画素駆動信号の供給タイミングを制御することを特徴とする投写型映像表示装置。
【請求項１０】
請求項１乃至請求項９のいずれかに記載の投写型映像表示装置において、光源から出射されて集光された光を光偏向手段に導くためのロッドプリズムを備えたことを特徴とする投写型映像表示装置。
【請求項１１】
請求項１０に記載の投写型映像表示装置において、前記ロッドプリズムは光の分散を緩和するようにテーパ形状を有していることを特徴とする投写型映像表示装置。
【請求項１２】
請求項１乃至請求項１１のいずれかに記載の投写型映像表示装置において、前記光偏向手段は、円盤状に複数の凸レンズから成る機能部を円周方向に沿って配置して成るレンズア

レイホイールであることを特徴とする投写型映像表示装置。

【請求項１３】

請求項１乃至請求項１１のいずれかに記載の投写型映像表示装置において、前記光偏向手段は、プリズムを回転自在に設けて成る構成であることを特徴とする投写型映像表示装置。

【請求項１４】

請求項１乃至請求項１１のいずれかに記載の投写型映像表示装置において、前記光偏向手段は、渦状に形成された光透過部を有し、この光透過部以外の領域に反射面を有する円盤部材から成ることを特徴とする投写型映像表示装置。

【請求項１５】

請求項１乃至請求項１１のいずれかに記載の投写型映像表示装置において、前記光偏向手段は、周面に周期的に光透過部と反射部とが交互に形成された円筒状部材から成ることを特徴とする投写型映像表示装置。

【請求項１６】

請求項１０又は請求項１１に記載の投写型映像表示装置において、前記ロッドプリズムは光入射方向と光出射方向とが異なるように折り曲げられ、光偏向手段は周面に周期的に光透過部と反射部とが交互に形成された円筒状部材から成り、前記円筒状部材の内側に前記ロッドプリズムの全部又は一部が位置していることを特徴とする投写型映像表示装置。

【請求項１７】

請求項１４に記載の投写型映像表示装置において、前記円盤部材を光照射方向に対して斜めに配置し、前記円盤部材の反射面からの光を受ける位置に補助ミラーを設け、補助ミラーにて反射させた光を前記円盤部材の光透過部に導くように構成されたことを特徴とする投写型映像表示装置。

【請求項１８】

請求項１７に記載の投写型映像表示装置において、前記円盤部材は透明部材から成り、この透明部材の表裏両面に反射面が形成されていることを特徴とする投写型映像表示装置。

【請求項１９】

請求項１乃至請求項１８のいずれかに記載の投写型映像表示装置において、前記色分離手段により色分離された各色光は互いに等しい光路長で各色用のホールド型素子に導かれるように構成されたことを特徴とする投写型映像表示装置。

【請求項２０】

請求項１９に記載の投写型映像表示装置において、色分離前の光の光軸上に３原色光の二光と他の一光を分離する手段及び分離された３原色を合成する手段が配置され、前記光軸を中心に二光の光路と一光の光路は対称とされ、前記二光の光路の途中箇所でそのなかの一光が分離されて前記光軸上に導かれるように構成されていることを特徴とする投写型映像表示装置。

【請求項２１】

光源から照射された光を受けて透過させる際に当該光に循環的な偏向を生じさせる回転駆動型の照明装置において、光入射方向と光出射方向とが異なる折り曲げ型のロッドプリズムと、周面に周期的に光透過部と反射部とが交互に形成された円筒状部材とを備えて成り、前記円筒状部材の内側に前記ロッドプリズムの全部又は一部が位置していることを特徴とする照明装置。

【発明の詳細な説明】

【０００１】

【産業上の利用分野】

この発明は、投写型映像表示装置及び照明装置に関する。

【０００２】

【従来の技術】

液晶表示パネル（ＬＣＤ）、ディジタルマイクロミラーデバイス（ＤＭＤ）、プラズマディスプレイパネル（ＰＤＰ）といったディスプレイは、ホールド型ディスプレイと呼ばれ

ている。これは、図１に示すように、陰極線管（ＣＲＴ）がインパルス状の画像出力をするのに対し、ＬＣＤ等は、次の画像出力までその状態を維持することを意味する。このようなホールド型ディスプレイでは、動画像を表示した際に、ＣＲＴとは異なり、画像が不明瞭になってしまうという問題がある。

【０００３】

従来、動画像を表示した際のこれらの画質劣化は、デバイスの表示応答の遅さによるものであると考えられてきた。しかし、近年視覚の研究が進むにつれ、表示デバイスの応答速度が向上し、仮に即時応答となった場合においても、ある一定の画質劣化は避けられないことが判ってきた。このような画質劣化をホールドブラーリング（Ｈｏｌｄ　Ｂｌｕｒｉｎｇ）と呼ぶ。

【０００４】

ホールドブラーリングは人間の視覚情報処理系の積算効果によるものであり、図２に示すように、ＣＲＴ等のインパルス出力のディスプレイデバイスでは生じない現象である。人間は動画像を観測する際に、動画像中の物体を視線で追いかける。この時、眼球の追従速度は急激に変化できないため、通常の動画像のリフレッシュ期間（１７ｍｓ）では、ほぼ一定速度で運動する。しかし、ホールド型ディスプレイデバイスでは、図３及び図４（ａ）に示すように、同じ位置に所定期間（１７ｍｓ）同じ映像が出力される。このため、図４（ｂ）及び図５（ａ）に示すように、視線位置に対して表示されている映像は相対的に後退することになり、網膜上には後退する動きを伴った像が投影される。

【０００５】

ただし、これらは視覚情報処理系の前段でのことであり、実際に認知される速度は１７ｍｓよりも十分に遅い。これらの画像は、図５（ｂ）に示すように、一定期間内の積算が行われ、積算された画像が視覚として認知される。この結果、認知される画像は一定期間に網膜上で動いた軌跡を重ね合わせたようなぼやけたものとなる。この積算期間はブロッホの定理として知られており、５０ｍｓ～８０ｍｓ程度といわれている。これに対してＣＲＴの場合、図６（ａ）（ｂ）に示すように、一瞬出力された映像が積算されるだけである。追随によって積算を行っても、視線に対して戻る画像が網膜に投影されることがないため、鮮明な画像が認知されることとなる。

【０００６】

【発明が解決しようとする課題】

ホールドブラーリングを改善する最も一般的な手法は、ＣＲＴに近づけることである。ＣＲＴはインパルス出力であるため、前述のような問題は発生しない。このため、ホールド型ディスプレイの動画像表示特性を向上させる最も有力な方法は、図７（ａ）（ｂ）に示すように、液晶やＤＭＤへの照射光を間欠照射することにより、間欠表示を行うことである（特開平９－３２５７１５号公報参照：ＩＰＣ　Ｇ０９Ｆ　９／３５）。

【０００７】

しかし、実際には照射時間を６０％程度に制限するため、液晶の輝度も６０％に低下する。また、６０％という照射時間の制限は、ホールド障害による画質劣化の改善として十分なものとは言えない。当然ながら照射時間を短くすればする程改善効果はあがるが、明るいバックライトが必要となったり、電源等が大型化するなど、コストの上昇が大きな問題となる。

【０００８】

また、このような方法は高出力のランプを使用する液晶プロジェクターでは実現が困難である。ランプの点滅はランプへのダメージが激しく寿命に影響を及ぼす。またシャッタリングを行った場合にも、シャッターされた光の多くは熱となるため、放熱の問題が生じる。

【０００９】

直視型液晶ディスプレイにおいてバックライトを分離し、それぞれの点滅をスクロールすることによりシャッタリングと同じ効果を得る方法（特開２００１－２３５７２０号公報参照：ＩＰＣ　Ｇ０２Ｆ　１／１３３）がある。この方法も上述した方法と同様、同期の

調整が困難であり、表示輝度が低下するという問題がある。また、回路も大型化し、製造コストが大幅に増加する。

【００１０】

また、ホールド型ディスプレイの表示の際に一定期間毎に黒レベル表示を挿入する方法が提案されている（特開平１１－１０９９２１号公報参照：ＩＰＣ　Ｇ０９Ｆ　９／３６）。通常この一定期間は、フレームのリフレッシュ期間の間に位置しており、例えば１７ｍｓ期間中９ｍｓ期間は画像を表示し、残りの８ｍｓ期間は黒を表示するという方法をとる。この方法を用いた場合、同期は安定するが、表示輝度の低下は避けられない。また液晶等の場合では応答速度が速いデバイスが必要となる。

【００１１】

間欠表示以外のホールドブラーリング抑制方法としては、フレームレート変換がある。これはホールド型ディスプレイの場合、１７ｍｓ期間同じ画像が提示された結果、ブレが生じてしまうことに着目し、この期間に途中の画像を提示するものである。具体的には６０Ｈｚの画像を出力する際、それぞれの画像から各画像の中間に相当する画像を６０枚生成し、１２０Ｈｚの画像として表示する。この結果ホールドブラーリングの原因となる同じ画像が提示される期間が半分となる。この結果認識されるブラーリングは半分となり、６０Ｈｚの画像を表示した際よりも鮮明な画像が得られる。

【００１２】

しかしこの方法は中間の画像にある程度の正確性が要求され、現在の技術ではこのような中間画像を確実に生成できていない。

【００１３】

液晶プロジェクターに関し、特開２００２－６８１５号公報（Ｇ０９Ｇ　３／３６）には、集光ミラーによってパネル上に光スクロールする方法が開示されている。しかしながら、ここで開示されている集光システム（ポリゴンミラー）では反射作用によって光スクロールを行なうため、プロジェクターを構成した場合に光学系が非常に大きくなる欠点がある。

【００１４】

本発明は、上記の事情に鑑み、小型化可能な光学系にてホールド型表示素子上に光スクロールを行ない、ホールドブラーリングと呼ばれる動画像表示の際の画質劣化を改善できる投写型映像表示装置を提供することを目的とする。

【００１５】

【課題を解決するための手段】

この発明の投写型映像表示装置は、照射された光を受けて透過および／または反射させる際に当該光に循環的な偏向を生じさせる回転駆動型の光偏向手段と、光偏向手段からの光を３原色に分離して３つのホールド型表示素子に各々導く色分離手段と、各ホールド型表示素子を経て得られる各色映像光を合成して投写する投写手段と、各ホールド型表示素子に画素駆動信号を与える素子駆動手段とを備え、各ホールド型表示素子上で当該素子よりも小さな面積で集光される各色光が循環的にスクロールされるように構成されたことを特徴とする。

【００１６】

上記の構成であれば、各ホールド型表示素子上で当該素子よりも小さな面積で集光される各色光が循環的にスクロールされるため、ホールド型表示素子に対して実質的に光の間欠照射が行なわれることになり、ホールドブラーリングを抑制することができる。そして、光スクロールを生じさせるための光偏向手段は、照射された光を受けて主に透過させる際に当該光に循環的な偏向を生じさせるから、ポリゴンミラーのようなシステムに比べて光学系の小型化が容易となる。

【００１７】

前記素子駆動手段は、各ホールド型表示素子上で照明領域が通り過ぎる位置に存在する画素に対して次のフレームの画素駆動信号を供給し始めるように構成されているのがよい。これによれば、スクロール光の照射期間（表示時）を画素の応答終了時点（表示目標値達

成時点）に合わせることが容易となる。

【００１８】

画素駆動信号の供給をフレームレートのＮ倍（Ｎは２以上の整数）で行い、画素への照明タイミングと当該画素の応答平坦化時とを一致させるように構成されているのがよい。ここで、画素の応答は指数関数的に変化するため、スクロール光の照射期間中において画素の輝度変化が生じ、二重映像が感じられてしまうが、上記のごとく画素への照明タイミングと当該画素の応答平坦化時とを一致させることで、輝度変化による二重映像を低減することができる。

【００１９】

上記画素応答の平坦化を図る構成において、画素の必要応答値が得られる画素駆動信号よりも過大な画素駆動信号を供給して遅れ補償を行なうように構成されているのがよい。これによれば、画素の応答速度が低い場合にも対応できる。そして、かかる構成においては、前フレームの最終画素値と今回の画素値とによって前記過大な画素駆動信号のデータが得られるテーブルを備えるのがよい。

【００２０】

フレーム周期と光偏向手段による偏向周期とのずれを検出し、このずれが解消されるように又はずれが一定に生じるように偏向周期を補正制御する制御手段を備えているのがよい。これによれば、光偏向手段の回転精度にばらつきがある場合にも対応できる。

【００２１】

また、上記ずれを生じた際の画素の応答と当該画素への光照射期間とで定まる画素の輝度値を、ずれを生じない場合の予定輝度値に一致させる制御を行なうのがよい。これによれば、輝度変化の追従不足を解消できる。かかる構成においては、前記ずれに応じて画素応答の目標値よりも高い値を設定して画素駆動信号を供給するようにしてもよいし、或いは、前記ずれに応じて画素駆動信号の供給タイミングを制御するようにしてもよい。

【００２２】

光源から出射されて集光された光を光偏向手段に導くためのロッドプリズムを備えてもよい。また、このロッドプリズムは光の分散を緩和するようにテーパ形状を有しているのがよい。

【００２３】

前記光偏向手段としては、円盤状に複数の凸レンズから成る機能部を円周方向に沿って配置して成るレンズアレイホイールを用いてもよいし、プリズムを回転自在に設けて成るスクローリングプリズムを用いても良いし、渦状に形成された光透過部を有し、この光透過部以外の領域に反射面を有する円盤部材から成るものを用いてもよし、周面に周期的に光透過部と反射部とが交互に形成された円筒状部材を用いてもよい。また、ロッドプリズムは光入射方向と光出射方向とが異なるように折り曲げられ、光偏向手段は周面に周期的に光透過部と反射部とが交互に形成された円筒状部材から成り、前記円筒状部材の内側に前記ロッドプリズムの全部又は一部が位置していてもよい。また、この発明の照明装置は、光源から照射された光を受けて透過させる際に当該光に循環的な偏向を生じさせる回転駆動型の照明装置において、光入射方向と光出射方向とが異なる折り曲げ型のロッドプリズムと、周面に周期的に光透過部と反射部とが交互に形成された円筒状部材とを備えて成り、前記円筒状部材の内側に前記ロッドプリズムの全部又は一部が位置していることを特徴とする。

【００２４】

前記渦状に形成された光透過部を有する構成、当該円盤部材を光照射方向に対して斜めに配置し、前記円盤部材の反射面からの光を受ける位置に補助ミラーを設け、補助ミラーにて反射させた光を前記円盤部材の光透過部に導くように構成してもよい。前記円盤部材は透明部材から成り、この透明部材の表裏両面に反射面が形成されていてもよい。

【００２５】

これらの投写型映像表示装置において、前記色分離手段により色分離された各色光は互いに等しい光路長で各色用のホールド型素子に導かれるように構成されているのがよい。か

かる構成において、色分離前の光の光軸上に３原色光の二光と他の一光を分離する手段及び分離された３原色を合成する手段が配置され、前記光軸を中心に二光の光路と一光の光路は対称とされ、前記二光の光路の途中箇所でそのなかの一光が分離されて前記光軸上に導かれるように構成されていてもよい。

【００２６】

【発明の実施の形態】

以下、この発明の実施形態の投写型映像表示装置を図８乃至図４１に基づいて説明する。

【００２７】

（実施形態１）

図８はこの実施形態の投写型映像表示装置を示したブロック図である。光源１は、超高圧水銀ランプ、メタルハライドランプ、キセノンランプ等から成る。集光部２は、光源１から出射された光を受けて反射する楕円鏡、或いは放物面鏡と集光レンズとの組み合わせ等から成る。集光部２にて集光された光はインテグレータ（ロッドプリズム）３に入射し、その内面で全反射作用を繰り返した後に均一な面光源となって出射される。そして、このようにインテグレートされた光は光偏向手段であるレンズアレイホイール（ＬＡＷ）４に向けて出射される。レンズアレイホイール４上における光照射領域（大きさ）は、後述する液晶表示パネル上においてその横の長さと略同一で縦の長さが例えば１／３となる大きさとしている。なお、インテグレータ３として、受光側の面よりも出射側の面の方が大きくなるテーパ形状を有するものを用いれば、出射光においてその分散をできるだけ緩和することができる。

【００２８】

レンズアレイホイール４は、円盤形状に複数の凸レンズ機能部を円周方向に沿って配置して成るものである。凸レンズ機能部は通常の凸レンズを扇型に切り取った形状を有する。このレンズアレイホイール４は、その円盤形状の中心部を回転中心（回転軸）とし、モータ１１によって回転駆動され、前記回転中心（回転軸）と平行な方向から光を受ける。これにより、複数の凸レンズ機能部は前記インテグレータ３の光出射面側を循環的に通過することになり、凸レンズ機能部の周期的な位置変位が生じて光偏向が周期的に行なわれることになる。

【００２９】

リレーレンズ光学系５は偏向された光を入射し、映像光生成系６における色分離ダイクロイックプリズム６ａへと像伝達を行なう。色分離ダイクロイックプリズム６ａに入射した光はＲ（赤）光、Ｇ（緑）光、Ｂ（青）光に分離され、それぞれＲ用の液晶表示パネル７Ｒ、Ｇ用の液晶表示パネル７Ｇ、Ｂ用の液晶表示パネル７Ｂに導かれる。前記のレンズアレイホイール４による光偏向により、各液晶表示パネル７Ｒ，７Ｇ，７Ｂに導かれる色光（照射形状は短冊状）は、当該パネル上に各々同じタイミングでスクロール照射される。このスクロール照射の様子を図１０乃至図１６に示す。なお、これら図１０乃至図１６において、レンズアレイホイール４と液晶表示パネルとの間に位置させたレンズ状の部材は、リレー光学系５及び色分離ダイクロイックプリズム６ａ等を表している。

【００３０】

そして、各液晶表示パネル７Ｒ，７Ｇ，７Ｂに入射した各色光は当該パネル上の画素の応答（光透過度）の状態で変調され、この変調により得られた各色映像光は、色合成ダイクロイックプリズム６ｂにて合成されてカラー映像光となり、投写レンズ８にてスクリーン９に投影される。

【００３１】

このように、各色の短冊状の照明光が液晶表示パネル７上で循環的にスクロールすることにより、当該パネルの一画素に着目するとフレーム期間中の一部の期間のみ表示し、残りの期間は黒となる結果、間欠表示が実現され、動画像を表示した場合のブラーリングが改善される。例えば、短冊状の照明領域をパネル（画面）全体の１／３にした場合には、図１７（ａ）（ｂ）（ｃ）に示すように、１／３期間表示で２／３期間非表示という間欠表示と等価となる。

【００３２】
次に、信号処理系について説明していく。パネル駆動部１５は入力された映像信号に基づいて各液晶表示パネル７Ｒ，７Ｇ，７Ｂを駆動する。すなわち、映像信号に基づいて各液晶表示パネルの各画素の光透過度を設定する素子駆動電圧を生成して各画素に与える。同期分離回路１４は映像信号から垂直同期信号を取り出してスクロール位相検出部１２に与える。スクロール位相検出部１２はレンズアレイホイール４の回転周期と垂直同期とから位相差を検出する。レンズアレイホイール４の回転周期情報は、例えば、ロータリエンコーダの構成によって得ることができる。モータ１１の回転を制御する回転制御部１３は、前記位相差を示す信号をスクロール位相検出部１２から受け取り、レンズアレイホイール４の回転周期を垂直同期に合致させるよう制御を行なう。この制御内容を図９のフローチャートに示す。回転周期が垂直同期から遅れれば回転速度を高めるべくモータ１１への供給電圧（或いはパルス数やパルス幅等）を増加し、早ければ回転速度を低くするべくモータ１１への供給電圧（或いはパルス数やパルス幅等）を減少し、一致すればそのままとする。

【００３３】
ところで、液晶表示パネルの応答速度が高速であれば問題はないのであるが、通常の液晶表示パネルでは十分な応答速度が得られないため、スクロール光の照射期間中に画素の最終応答が完了していないことが生じる。こように画素の最終応答が完了していないと、画像データに対応した輝度値が得られていないことになる。そこで、図１８に示すように、照射光がスクロールした直後の画素に次のフレームデータを書き込む。液晶の応答例を図１９に示す。液晶は図のように反応するため、理想的には▲２▼で示す期間において光照射が行なわれるようにする。すなわち、図２０に示すように、液晶応答と表示（パネル照明）のタイミングを設定することとする。しかし、通常の透過型液晶プロジェクターに用いる液晶パネルはフレーム期間、つまり１７ｍｓ期間では応答出来ない。このためフレームの書き込みタイミングに至っても２フレーム前の画像が液晶パネル上に残存していることになり、全期間を通じて常に二重像が表示されていることになる。このようなパネルを用いて照射光のスクローリングによる間欠表示を行った場合、二重像が強調される結果となり、画質が向上したという印象が得られない。このため、パネルへのデータ書き込みにオーバードライブという手法を用いて１７ｍｓ期間での応答を実現し、二重像を低減する。透過型液晶プロジェクターでは、例えば１００→２００に液晶を応答させる場合には書き込み期間内に１８０までしか応答しないとする。しかし、例えば２００ではなく２３０を入力した場合に書き込み期間内に２００まで応答するのであれば、この場合の入力値としては２００ではなく２３０を用いれば良い。この様子を図２１に示す。これらは１７ｍｓで応答しないパネルの例である。図２１（ａ）では２フレーム期間で所望の値に応答していることがわかる。このため、図２１（ｂ）に示すように変化分を強調することにより、液晶の応答を速くする。この結果、１７ｍｓ期間内に液晶が応答し、二重像を低減することが可能となる。また、図１９に示すように照射光はフレーム書き込みの期間に略一致するのが望ましい。液晶応答が変化している期間には二重像が発生しているためである。この場合、照射光の期間は図１８に示すように書き込み期間の直前に合わせることが考えられる。しかしこの場合照射開始点では強い二重像となっており、この結果表示した画像からは比較的強い二重像が認識される。この場合、図１９の▲２▼に示すように書き込み期間を若干超えることにより比較的良い結果が得られる。これは動き部分の両側に薄い影のように像が見えるようになる、所謂薄い三重像の状態である。この状態の方が主観画質が高いという結果が得られている。以下の実施例では、混乱を避けるためにフレーム書き込みの直前に照射光を合わせるものとして説明を行うが、この照射パターンに限定されるものではなく、前述の説明のようにフレーム書き込み期間に略一致させることにより、主観的な画質を向上させる手法を用いることに何ら制約を与えないことを付記しておく。

【００３４】
（実施形態２）
実施形態２の投写型映像表示装置の構成を図２６に示す。そして、図２１乃至図２５及び

図２７によって問題点を示しつつ、この問題点を解決できるこの実施形態の投写型映像表示装置を説明していく。

【００３５】

図２１（ａ）には実施形態１による液晶応答状態を模式的に示し、図２１（ｂ）には実施形態２による液晶応答状態を模式的に示している。

【００３６】

ここで、液晶の応答は指数関数的な変化となり、理想的な光照射を行った場合でも、図２２に示すように表示期間中に輝度の変化があり、これが二重像となって認識されてしまう。そこで、液晶画素への照明タイミングと当該液晶画素の応答平坦化時とを一致させる。具体的には、図２３に示すように、液晶画素への書き込みをフレームレートの整数倍で行う。例えば６０Ｈｚで駆動する系では１２０Ｈｚで書き込みを行う。そして最初の非表示の１／１２０秒期間内に希望値（目標値）まで液晶を応答させ、残りの表示期間である１／１２０秒期間において液晶応答を一定とする。

【００３７】

ただし、ほとんどの液晶は１２０Ｈｚでは応答できないため、希望の値に液晶が応答するように、図２６に示すオーバードライブ回路２１にてオーバードライブ制御を行う。オーバードライブ制御は液晶に希望の値よりも大きな変化値を入力して、遅れを補償するものである。図２２に示すように、希望する値を入力しても書き込み期間内に液晶は応答できない場合が多い。このため、例えば１００→２００に液晶を応答させる場合には書き込み期間内に１８０までしか応答しないとする。しかし、例えば２００ではなく２３０を入力したとして書き込み期間内に２００まで応答するのであれば、２００ではなく２３０を入力すればよい。この書き込み期間内に希望値まで液晶が応答する値は、液晶の現在の状態と目標とする状態、つまり前のフレームでの値と書き込むフレームでの値とにより決定される。また、これらの値は線形ではないため、関数ではなくテーブル的に決定される。テーブルは書き込む前の状態の画素値（前のフレームでの値）及び次に書き込みたい画素値（書き込むフレームでの値）を入力（読出アドレス）とする構成とすればよい。そして、このテーブルでは、出力データとして、１７ｍｓ後に書き込みたい画素値（目標値）になるために必要とするパネルへの入力データ値（過大な書込値）が得られる。このためには、前のフレームの画素値をフレームメモリ２２（図２６参照）に記憶し、各画素に対しフレームメモリ２２上の値と書き込もうとする値とをアドレスとしてテーブルを参照ことにより、書き込む画素データ（パネルへの入力データ値）がテーブルから得られる。

【００３８】

通常ドライブとオーバードライブの比較を図２４に示す。同図（ａ）は通常ドライブの液晶応答であり、同図（ｂ）がオーバードライブの液晶応答である。同図（ｂ）の応答状態とパネル照明期間との関係を図２５に示す。この図２５から分かるように、パネル照明期間と当該液晶画素の応答平坦化時とが一致することになり、パネル照明期間内での輝度変化を抑え、二重映像防止が図られる。

【００３９】

図２７はオーバードライブ回路２１の書込タイミングを表示素子上で表した図である。表示が終了した部分（照明領域が過ぎ去った箇所）から次のフレームデータを書き込むが、これは上述したような応答速度対応が必要なためにオーバードライブ書き込みを行うことになる。そして表示期間に入る前に正規の値を書き込むことで、以降の表示期間（１フレーム期間の残り）における液晶応答を平坦状態に保持する。

【００４０】

（実施形態３）

実施形態３の投写型映像表示装置の構成を図３０に示す。そして、図２８及び図２９に基づいて前述の実施形態の構成での問題点を示しつつこの実施形態を説明していく。

【００４１】

問題とするはレンズアレイホイール３の回転精度（モータ１１の回転精度）である。照明位置がフレーム書き込みのタイミングに必ず一致するのであれば問題ないのであるが、通

常のモータ１１の回転速度は完全には安定しない。このため、光の照射期間（表示期間）はフレーム期間中で前後することになる。この現象は、２つの状態に分けられる（図１９参照）。まず、理想的な状態は、図２８（ａ）に示すように、表示期間が垂直同期の位相に略合致する状態である。これに対し、図２８（ｂ）に示すように、表示期間が垂直同期の位相に対して大きくシフトした場合には二重像が知覚されることになる。この段階では液晶が応答中であるため、液晶パネルに表示されているのは前フレーム画像と書き込んだフレーム画像とが表示された二重像である。この結果、知覚される画像も二重像となり、大きな画質劣化として認識される。図２８ではフレームレートと書き込みレートが同じ場合を示している。なお、図２５に示したごとく、画素応答を早めて平坦化させる場合においては、フレーム周期と光偏向手段による偏向周期とのずれが、フレーム周期の位相に対して画素への光照射期間が早まる側で生じるように偏向周期を補正制御するようにしてもよい。

【００４２】

この実施形態３では、上記二重像の問題に対して、図２８（ｃ）に示すようなオーバードライブ法による解決を開示する。ここでのオーバードライブは、光の照射期間（表示期間）で二重像が消えるように応答を間に合わせることにある。すなわち、光の照射期間（表示期間）の箇所で液晶応答が間に合うように、入力画素値よりもオーバーした値を画素値として入力する（強調する）。例えば、５０から１００に変化する場合に１３０を、１００から５０に変化する場合に３０を入力する。これらの値は液晶応答速度、及び照射しているタイミングによって決定され、照射したタイミング（垂直同期との位相差の程度）で二重像が消えるように入力値が強調される。

【００４３】

ここでのオーバードライブでは、テーブルの入力に更に位相差が入ることになる。この場合の目標値は、図２８（ｃ）のパターンで形成される面積が図２８（ａ）のパターンでの面積と同じになるように決定されるべきである。このため、前のフレームの値及び書き込もうとする画素データの値（目標値）、そして位相差により実際の書込値が決定される。

【００４４】

この場合に注意が必要なのは、通常のオーバードライブとこの実施形態３におけるオーバードライブとの相違である。通常のオーバードライブでは、入力された画素値が最終目標値となるように書き込みを行うため、液晶応答のフレーム期間の最終値は入力画素データと同一である。従って、次のフレームの書き込みを行う場合には前記入力画素データと次のフレームの入力画素データとを比較し、書込値を決定すればよい。これに対し、この実施形態３の位相差を加味したオーバードライブは、垂直同期との位相差の程度に対応してオーバードライブの程度が変わることになり、フレーム期間の最終値もこれによって変わる。従って、フレーム期間の最終値は入力画素データと同一にはならない。ゆえに、次のフレームの書き込みを行う場合にはフレーム期間の最終値に相当するデータをオーバードライブ回路３１の側からフレームメモリ３２に対して書き込んでおき、このフレーム期間の最終値に相当するデータと次のフレームの入力画素データとを比較し、書込値を決定することになる。

【００４５】

繰り返しになるが、通常のオーバードライブと位相差を加味したオーバードライブとの相違を更に以下に述べていく。図２９において、点線は通常のオーバードライブを用いた場合の液晶応答を示している。Ａは画素値（フレームの入力画素データ）であり、この画素値Ａよりも大きな値を液晶表示パネルに入力することにより、液晶は実線のような応答を示す。液晶はフレームの切り替えのタイミングで画素値、つまり目標レベルまで応答しているため、通常のオーバードライブにおいては、次のフレームでのオーバードライブは画素値Ａに基づいて行えばよい。だが、位相差を加味したオーバードライブでは、実際に光が照射されている期間の面積を目標値として入力するため、フレーム期間の最終値はＣのようになる。このため、次のフレームのオーバードライブは、このＣの値を基準に行うことになる。オーバードライブ回路３１は、フレームの入力画素データ（Ａ）と、位相差を

加味したオーバードライブによる実際の書込値（印加電圧Ｂ）と、によってフレーム期間の最終値（Ｃ）が与えられるテーブルを内部に搭載し、フレーム期間の最終値（Ｃ）をフレームメモリ３２に与える。そして、次のフレームにおいてはそのフレームの入力画素データと、フレームメモリ３２から受け取った前記フレーム期間の最終値（Ｃ）とスクロール位相検出部１２から受け取った位相差情報とにより、オーバードライブを行なうことになる。

【００４６】

（実施形態４）

実施形態４の投写型映像表示装置を図３１乃至図３３に基づいて説明する。この実施形態では、実施形態３と同様、二重像の問題を解決するものであるが、実施形態３とは異なる手法を提案するものである。

【００４７】

この実施形態の投写型映像表示装置は、図３１に示すように、映像データを格納するメモリ４１及び読出タイミング制御回路４２を備える。メモリ４１によって映像データ（フレーム）を記憶し、実際に供給されてくるフレームより１フレーム前の映像データを読出タイミング制御回路４２に与える。読出タイミング制御回路４２は、メモリ４１から順次画素データを読み出してこれをパネル駆動部１５に供給するのであるが、スクロール位相検出部１２から位相差情報を受け取り、この位相情報（スクロールずれ）に応じて前記画素データの供給タイミングを調整する。これにより、図３３における（ａ）に示す位相ずれ無しの状態から図３３における（ｂ）に示すような位相ずれが生じると、これがセンサ（スクロール位相検出部１２）の出力（位相情報）として現れ、読出タイミング制御回路４２の制御により、データの書き込み位置（パネルへの供給タイミング）は早い期間にシフトされる。これにより、図３２（ｃ）に示すように、垂直同期と照明パターンのずれに合わせて、データを読み出すタイミングと液晶パネルに書き込むタイミングが調整され、表示輝度が保証されることになる。

【００４８】

なお、レンズアレイホイール（ＬＡＷ）に替えて、スクロール円盤４Ａを用いることができる。このスクロール円盤４Ａは一部に透明部分を設け、残りをミラーとしたものに相当する。このスクロール円盤４Ａを図３４に示す。図３４において、４Ａａが透明部分であり、４Ａｂがミラー部分である。これにより、図３５に示すように、例えばスクロール円盤の透過部分の期間のみ白色光が液晶表示パネルに投射され、残りはロッドインテグレータ３内部に戻り、反射して再利用されることになる。

【００４９】

図３６に光偏向手段として白黒ホイール４Ｂを示す。光を入射する部分に角度を設けたインテグレータ３′を構成し、その周囲に円筒状の白黒ホイール４Ｂを形成する。このホイール４Ｂはインテグレータ３′の出射光を、フレーム期間毎に一部透過、残りを反射するという回転構成になっており、このホイール４Ｂを回転することにより液晶パネル上にスクロール光を得る。

【００５０】

通常のロッドインテグレータ（３）は直線的な形状をしているが、そのままでは白黒ホイール４Ｂ内において周面側へと光を照射できない。このため、途中で折り曲げたロッドインテグレータ３′を用いて光を入射する。ホイールの黒色部分は内部への反射面、白い部分は透明な透過面を示している。黒色の反射面に照射された光は内部に戻り、再利用される。透過面が画面の一部（図では約１／３）の領域となっているため、この領域に集光された光が液晶パネルに照射され、この白黒ホイール４Ｂを回転することにより照射光がスクロールすることになる。

【００５１】

図３６に示す構成では、ロッドインテグレータ３′の光入射側を折り曲げているが、図３７に示すように、光出射側を折り曲げたロッドインテグレータ３″を用い、小径の白黒ホイール４Ｃを用いることもできる。この場合には構造が横方向に長くなるが、小径の白黒

ホイール４Ｃを用いることができるため、高速回転のモータが使用できる。一般にモータは高速回転の方が制御しやすく、二重像の発生を防止する面からも効果が高い。

【００５２】

また、図３８に示すように、スクローリングプリズム４Ｄを用いることができる。このスクローリングプリズム４Ｄは、立方体形状を成し、図において紙面垂直方向に回転軸を設定し、ロッドインテグレータ３の光出射面に対して４つの面が周期的に角度を変えて対面し、光の屈折作用にて出射光がスクロールするように構成されたものである。

【００５３】

なお、以上説明した実施形態では、透過型の液晶表示パネルを用いたが、これに限るものではなく、反射型の液晶表示パネルやマトリクス状に配置された微小鏡を各々画素データに基づいて駆動するデバイスなども用いることができる。

【００５４】

図３９にスクロール円盤４４Ａを示す。図の太線四角枠は光源からの光が導かれる一次像形成領域を示している。また、図において、スクロール円盤４４Ａの光反射領域をハッチングにより示している。図４０にスクロール円盤４４ＡにおけるＡ－Ａ断面を示す。同図（ａ）（ｂ）（ｃ）はスクロール円盤４４Ａが回転することで光透過状態が変化する様子を示している。スクロール円盤４４Ａは、光軸に対して４５°傾いて配置されている。そして、光源からの導入光を阻害しない位置においてスクロール円盤４４Ａに対面させて補助ミラー４５を設けている。スクロール円盤４４Ａの光反射領域にて反射した光は、補助ミラー４５に導かれ、この補助ミラー４５にて反射した光はスクロール円盤４４Ａの光透過領域を透過する。スクロール円盤４４Ａの光透過領域の透過作用と前述の反射作用とにより、スクロール円盤４４Ａの一次像形成領域に導かれた光源からの光は無駄にされずに液晶表示パネルに導かれることになるので、表示映像の輝度向上が図れることになる。

【００５５】

図３９，４０に示したスクロール円盤４４Ａは透明円盤の片面に光反射領域を形成したが、透明円盤の両面に光反射領域を形成してもよい。透明円盤の両面を光反射に用いることで、片面のみ光反射面とする場合の制約から解放され、スクロール円盤の設計容易化等が図れる。

【００５６】

また、図４１に照射光学系１００を示す。光源１０１は、メタルハライドランプやキセノンランプ等から成り、その照射光はパラボラリフレクタによって平行光となって出射され、インテグレータレンズ１０２へと導かれる。

【００５７】

インテグレータレンズ１０２は一対のレンズ群にて構成されており、個々のレンズ対が光源１０１から出射された光をスクロール光学系１０５の光入射領域へ導くようになっている。前述した一次像形成領域（スクロール用照明領域）は液晶表示パネルサイズに対して垂直方向に短くされており、インテグレータレンズ１０２の各レンズはこれに対応して垂直方向に短くされている。スクロール光学系１０５は、前述したレンズアレイホイール４やスクロール円盤４Ａ，４４Ａ等を用いて構成することができる。インテグレータレンズ１０２を経た光は、集光レンズ１０３、ミラー１０４、スクロール光学系１０５等を経た後、クロス配置されたダイクロイックミラー１０６ａ，１０６ｂへと導かれる。

【００５８】

ダイクロイックミラー１０６ａは赤色光成分及び緑色光成分を反射し、青色光成分は透過させる。ダイクロイックミラー１０６ａは青色光成分を反射し、赤色光成分及び緑色光成分は透過させる。ダイクロイックミラー１０６ａ，１０６ｂは、色分離前の光（一次像形成領域上の光）の光軸上に配置されている。また、同光軸上に色合成ダイクロイックプリズム６ｂが配置されている。前記光軸を中心に二光（赤色光及び緑色光）の光路と一光（青色光）の光路は対称とされ、前記二光の光路の途中箇所でそのなかの緑色光がダイクロイックミラー１１０によって分離されてミラー１１１により前記光軸上に導かれる。これにより、ダイクロイックミラー１０６ａからミラー１０９及びミラー１０８を経て赤色用

の液晶表示パネル７Ｒまでの光路長と、ダイクロイックミラー１０６ａからダイクロイックミラー１１０及びミラー１１１を経て緑色用の液晶表示パネル７Ｇまでの光路長と、ダイクロイックミラー１０６ｂからミラー１１２及びミラー１１３を経て青色用の液晶表示パネル７Ｇまでの光路長は、互いに等しくなっている。

【００５９】

ダイクロイックプリズムによる色合成光学系を用いる一般的な構成では、例えば、青色光の光路上にリレー光学系を配置することが行われているが、このような光学系をそのまま流用した場合、リレー光学系によって照射青色光のスクロールの方向が他の色光のスクロール方向と逆になることが生じる。上述のごとく、色分離してから各色の液晶表示パネルまでの光路長を等しくしたことで、ダイクロイックプリズムによる一般的な色合成光学系の構成を用いつつリレー光学系を不要にできることになり、スクロール方向の整合性確保と同時に光学部材の削減といった優れた効果が得られることになる。

【００６０】

なお、赤色光とシアン色光とに分離し、シアン色光の光路上において緑色光を分離する構成とし、上記と同様に各色光の光路長を等しくすることもできる。

【発明の効果】

以上説明したように、この発明によれば、小型化可能な光学系にてホールド型表示素子上に光スクロールを行ない、ホールドブラーリングと呼ばれる動画像表示の際の画質劣化を改善できる。更に、画素応答の平坦化による輝度変化低減（二重映像防止）や光偏向手段の回転ブレによる不具合等も解消して表示映像品質の向上を図ることができる。

【図面の簡単な説明】

【図１】ＣＲＴ及びホールド型表示素子の入力信号に対する光出力特性を示した説明図である。

【図２】ＣＲＴにおける表示画像及び視認特性を示した説明図である。

【図３】ホールド型表示素子における表示画像及び視認特性を示した説明図である。

【図４】同図（ａ）（ｂ）はホールド型表示素子における二重映像の発生を説明する説明図である。

【図５】同図（ａ）（ｂ）はホールド型表示素子における二重映像の発生を説明する説明図である。

【図６】同図（ａ）（ｂ）はＣＲＴでは二重映像が発生しないことを説明する説明図である。

【図７】同図（ａ）（ｂ）はホールド型表示素子において間欠照明を行なうことで二重映像が軽減されることを示した説明図である。

【図８】この発明の実施形態１の投写型映像表示装置を示したブロック図である。

【図９】映像同期信号とスクロール位相検出回路の出力とによってモータ制御を行なうことを示したフローチャートである。

【図１０】液晶パネル上への照明光のスクロールの様子を示した説明図である。

【図１１】液晶パネル上への照明光のスクロールの様子を示した説明図である。

【図１２】液晶パネル上への照明光のスクロールの様子を示した説明図である。

【図１３】液晶パネル上への照明光のスクロールの様子を示した説明図である。

【図１４】液晶パネル上への照明光のスクロールの様子を示した説明図である。

【図１５】液晶パネル上への照明光のスクロールの様子を示した説明図である。

【図１６】液晶パネル上への照明光のスクロールの様子を示した説明図である。

【図１７】同図（ａ）（ｂ）（ｃ）は液晶応答とスクロールによる間欠照明での液晶輝度との関係を示した説明図である。

【図１８】画面上でのスクロールの様子と画素データ書込との関係を示した説明図である。

【図１９】液晶応答と照明期間とによる表示映像品質の関係を示した説明図である。

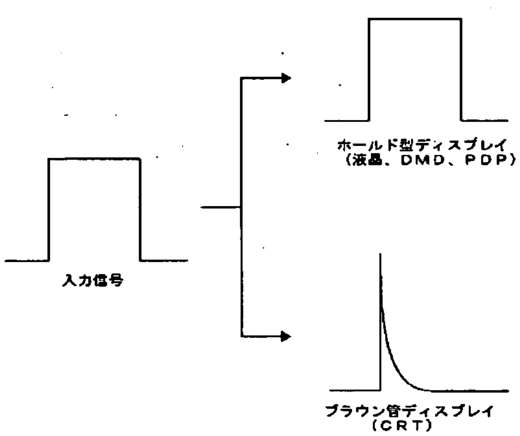
【図２０】液晶応答と照明期間との関係を示した説明図である。

【図２１】同図（ａ）は同期の倍速でデータ書込を行なう場合の液晶応答を示し、同図（

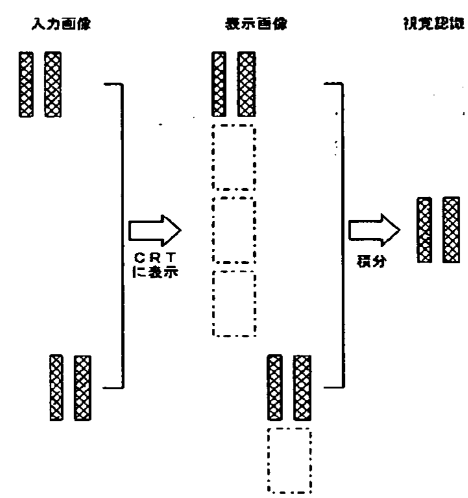
ｂ）は同書込において前半でオーバードライブを行い、後半で目標値のデータ書込を行なう場合（液晶応答平坦化）を示した説明図である。
【図２２】液晶応答と照明期間との関係を示した説明図である。
【図２３】液晶応答と照明期間との関係を示した説明図である。
【図２４】同図（ａ）は通常の書込を示し、同図（ｂ）はオーバードライブによる液晶応答平坦化を示した説明図である。
【図２５】オーバードライブによる液晶応答平坦化時に照明タイミング（表示）を合わせることを示した説明図である。
【図２６】この発明の第２実施形態の投写型映像表示装置を示したブロック図である。
【図２７】画面上でのスクロールの様子と画素データ書込との関係を示した説明図である。
【図２８】同図（ａ）（ｂ）（ｃ）は、フレーム期間内での照明期間のずれにより画素輝度に変化が生じること及びその解決策（オーバードライブ手法）を示した説明図である。
【図２９】フレーム期間内での照明期間のずれにより画素輝度に変化が生じることを解決する方法を示した説明図である。
【図３０】この発明の第３実施形態の投写型映像表示装置を示したブロック図である。
【図３１】この発明の第４実施形態の投写型映像表示装置を示したブロック図である。
【図３２】同図（ａ）（ｂ）（ｃ）は、フレーム期間内での照明期間のずれにより画素輝度に変化が生じること及びその解決策（フレーム読出制御）を示した説明図である。
【図３３】同図（ａ）は通常のフレーム読出制御を示し、同図（ｂ）は上記解決策のフレーム読出制御を示した説明図である。
【図３４】光偏向手段の他の例を示した説明図である。
【図３５】図３４の光偏向手段を用いた構成例を示した説明図である。
【図３６】光偏向手段の他の例を示した説明図であり、同図（ａ）は側面図、同図（ｂ）は正面図である。
【図３７】光偏向手段の他の例を示した説明図であり、同図（ａ）は側面図、同図（ｂ）は正面図である。
【図３８】光偏向手段の他の例を示した説明図である。
【図３９】光偏向手段の他の例であるスクロール円盤を示した説明図である。
【図４０】図３９のスクロール円盤におけるＡ－Ａ断面を示した図であって、同図（ａ）（ｂ）（ｃ）はそれぞれスクロール円盤が回転することで光透過状態が変化する様子を示している。
【図４１】照射光学系を示した説明図である。
【符号の説明】
１　光源
２　集光部
３　インテグレータ
４　レンズアレイホイール
４Ａ　スクロール円盤
４Ｂ　白黒ホイール
４Ｃ　白黒ホイール
４Ｄ　スクローリングプリズム
５　リレーレンズ
６　映像光生成系
７Ｒ，７Ｇ，７Ｂ　液晶表示パネル
１１　ステッピングモータ
１２　スクロール位相検出部
１３　回転制御部
１４　同期分離部
１５　パネル駆動部

２１　オーバードライブ回路
２２　フレームメモリ
３１　オーバードライブ回路
３２　フレームメモリ
４１　メモリ
４２　読出タイミング制御部
４４Ａ　スクロール円盤
４５　補助ミラー
１００　照射光学系
１０１　光源
１０２　インテグレータレンズ
１０５　スクロール光学系
１０６ａダイクロイックミラー
１０６ｂダイクロイックミラー
１１０　ダイクロイックミラー

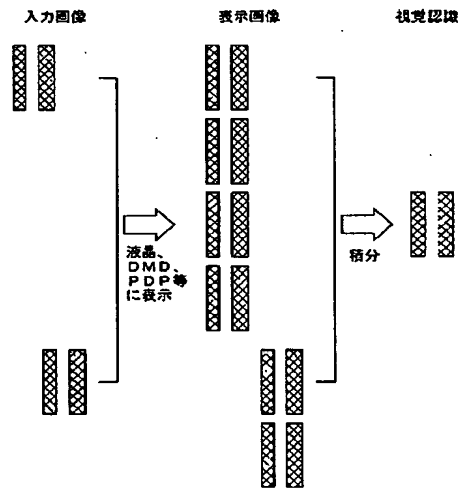
【図１】



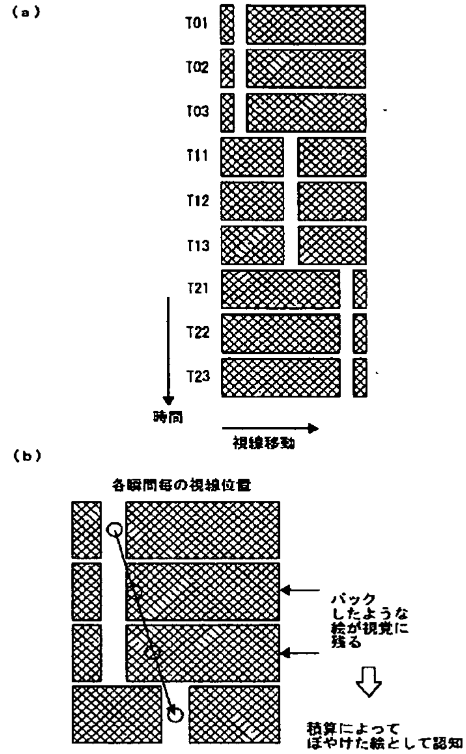
【図２】



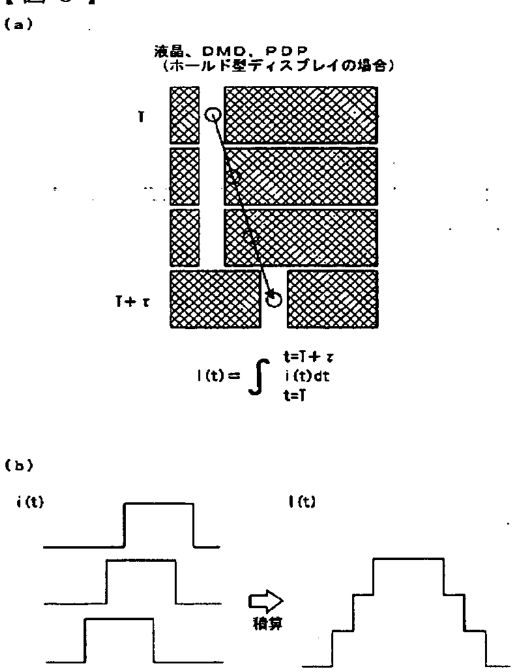
【図３】


入力画像
表示画像
視覚認識
液晶、
DMD、
PDP等
に表示
積分

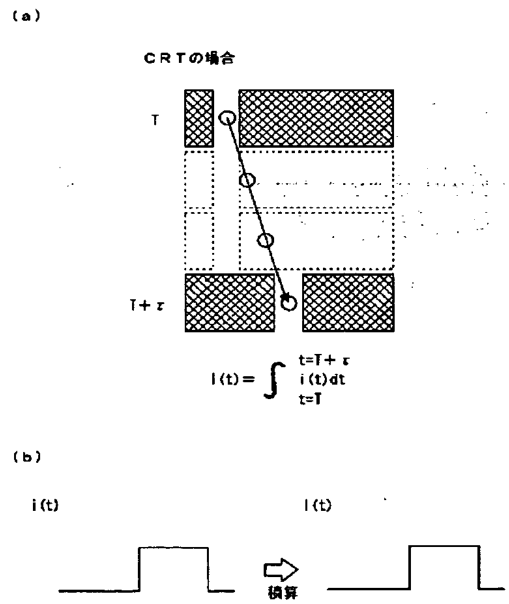
【図４】


(a)
T01
T02
T03
T11
T12
T13
T21
T22
T23
時間
視線移動
(b)
各瞬間毎の視線位置
バックしたような絵が視覚に残る
積算によってぼやけた絵として認知

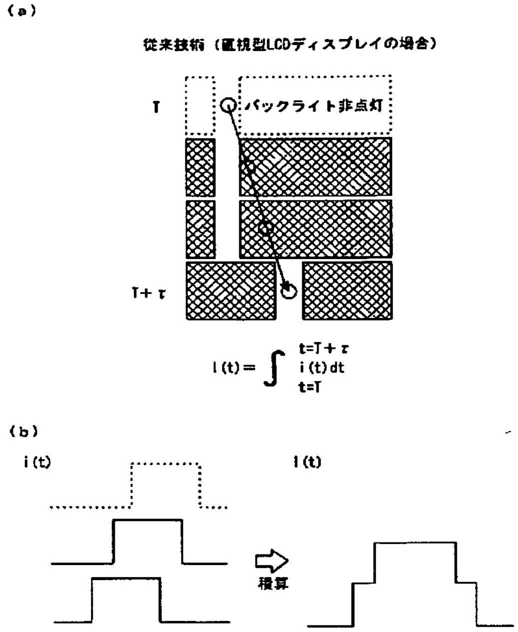
【図５】


(a)
液晶、DMD、PDP
(ホールド型ディスプレイの場合)
T
T+τ
$I(t)=\int_{t=T}^{t=T+\tau} i(t)dt$
(b)
i(t)
I(t)
積算

【図６】


(a)
CRTの場合
T
T+τ
$I(t)=\int_{t=T}^{t=T+\tau} i(t)dt$
(b)
i(t)
I(t)
積算

【図７】



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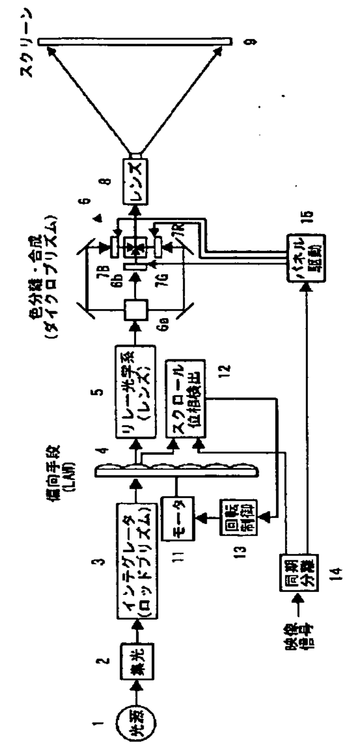

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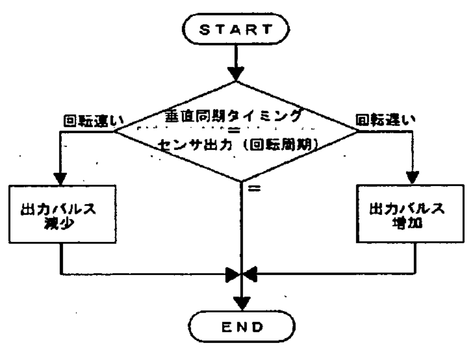

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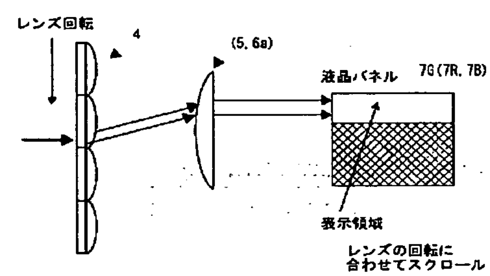
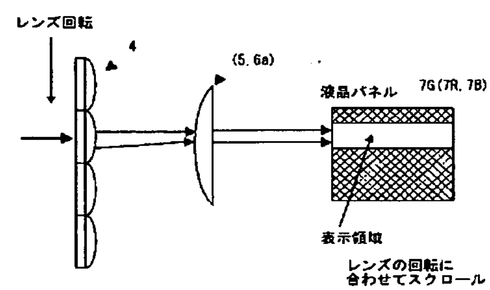


【図１１】



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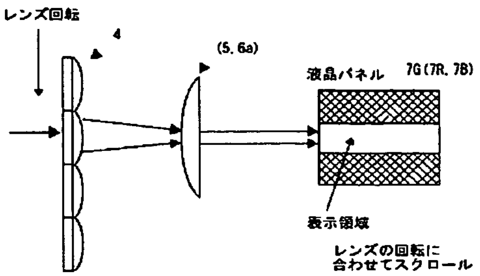

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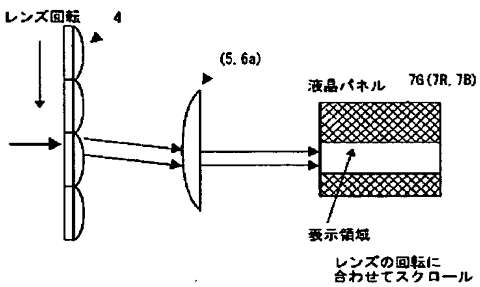

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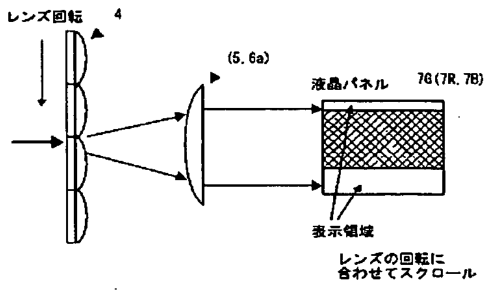

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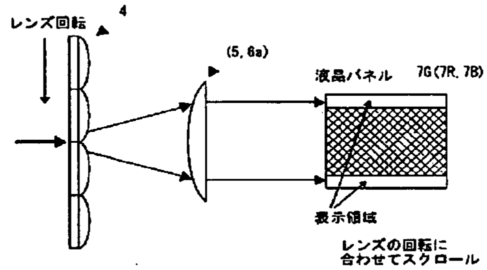

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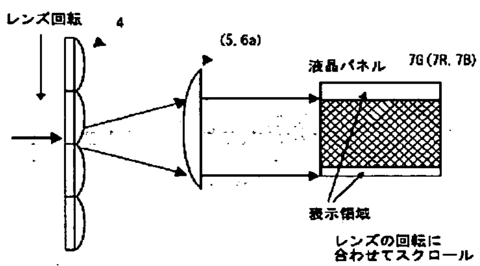

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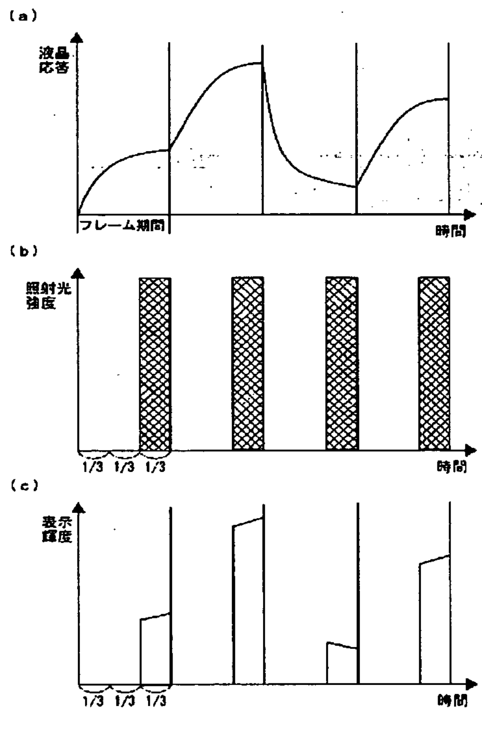

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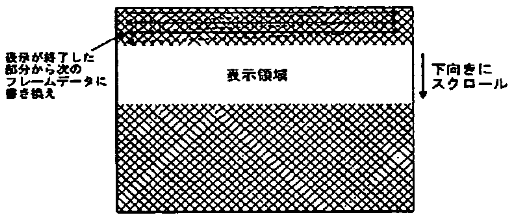

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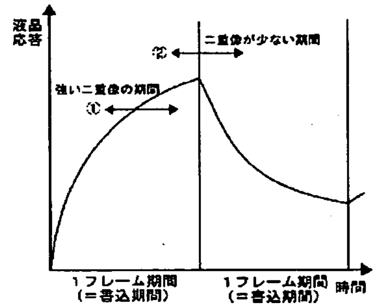

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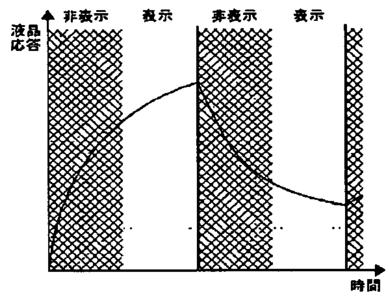

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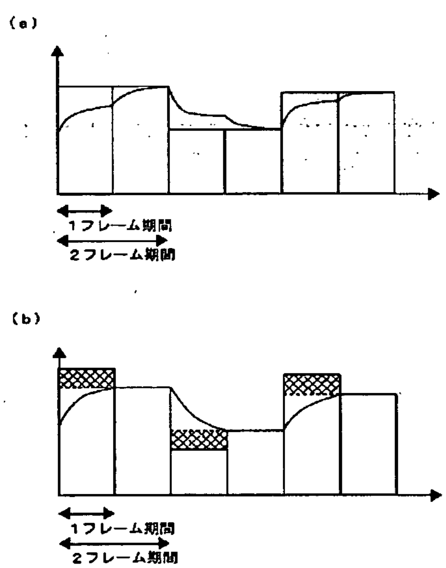

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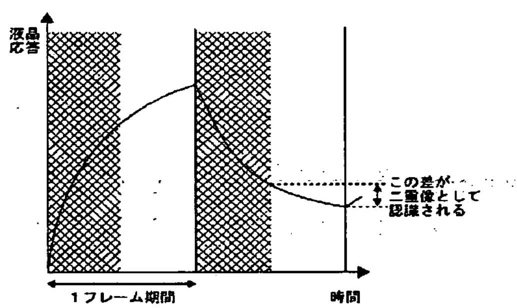

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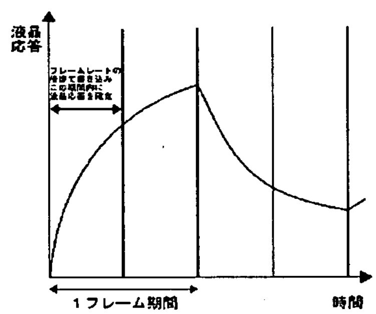

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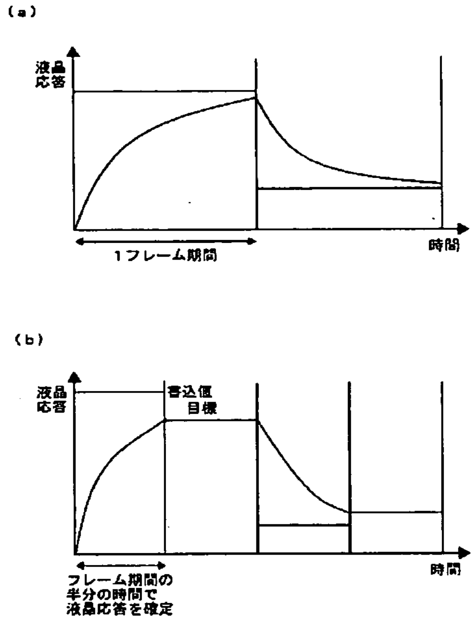

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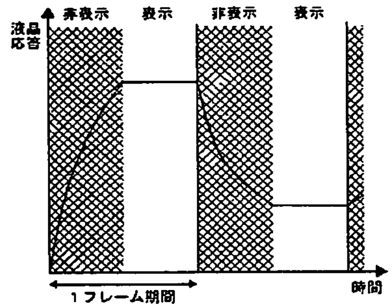

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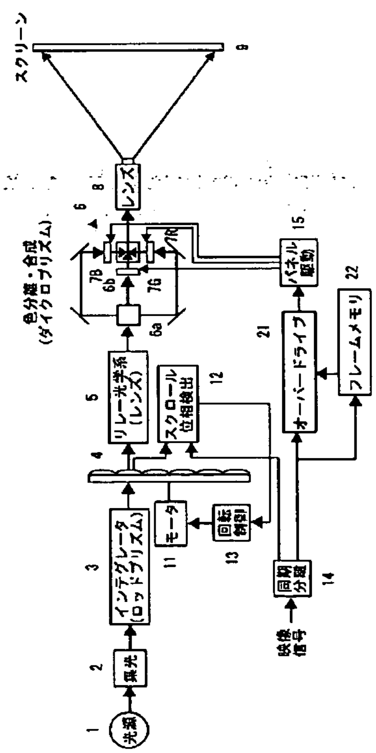

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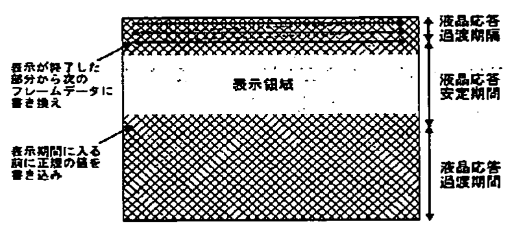

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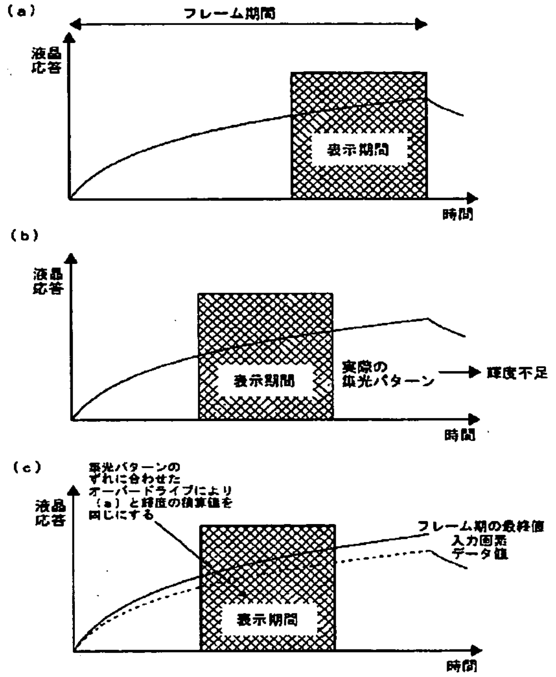

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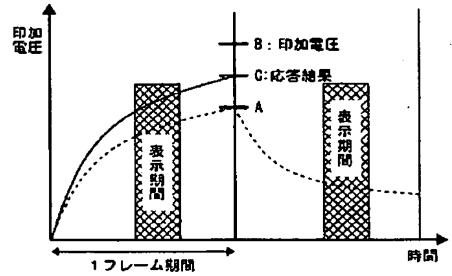

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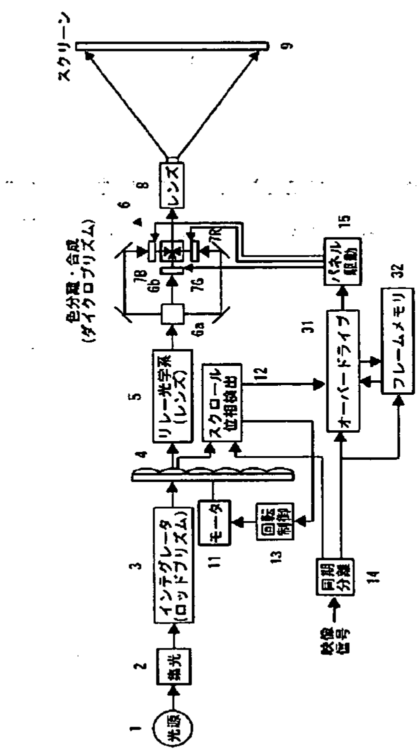

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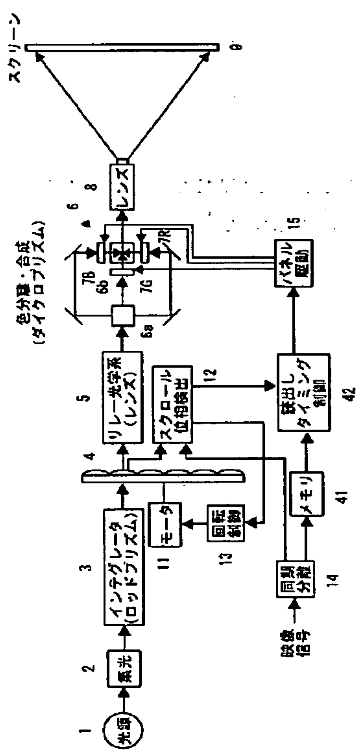

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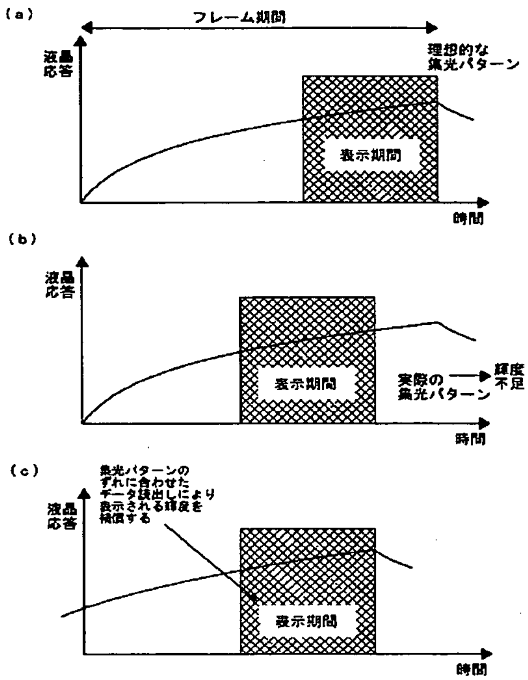

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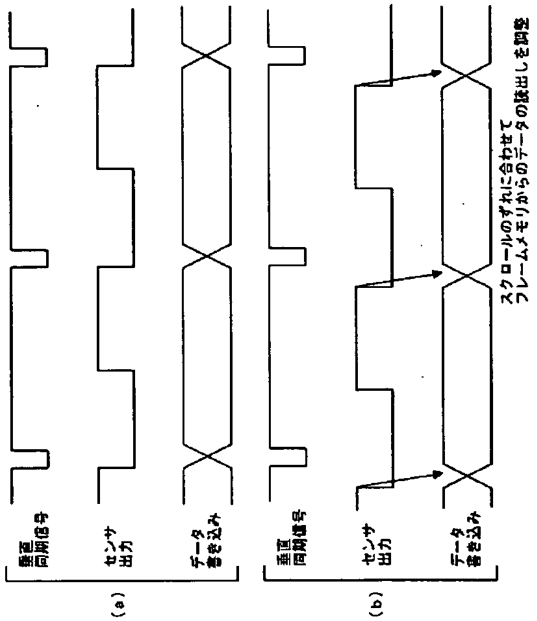

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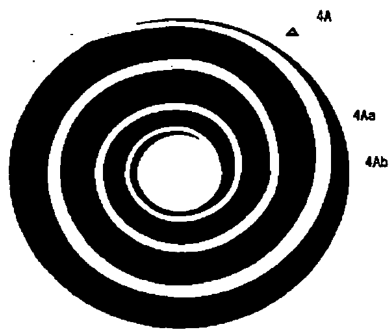

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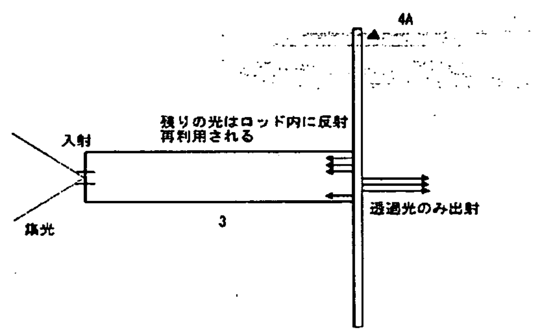

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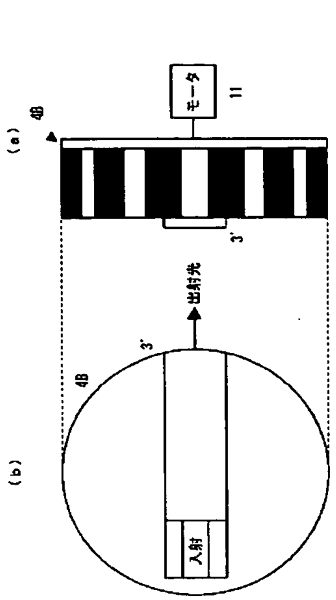

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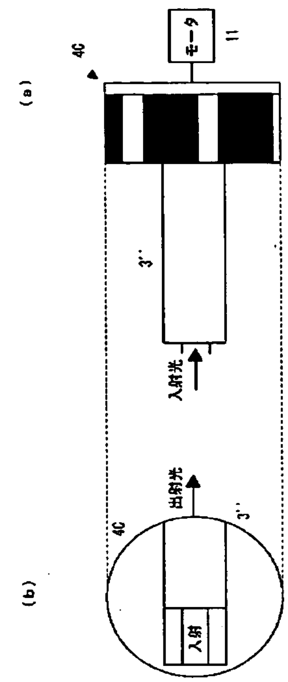

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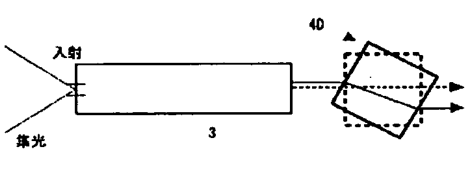

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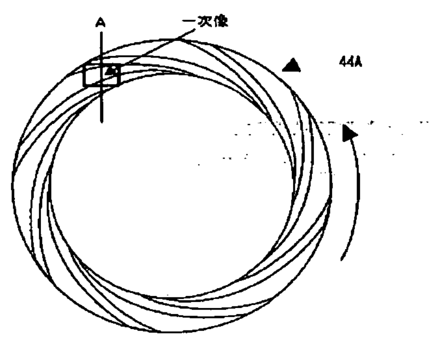

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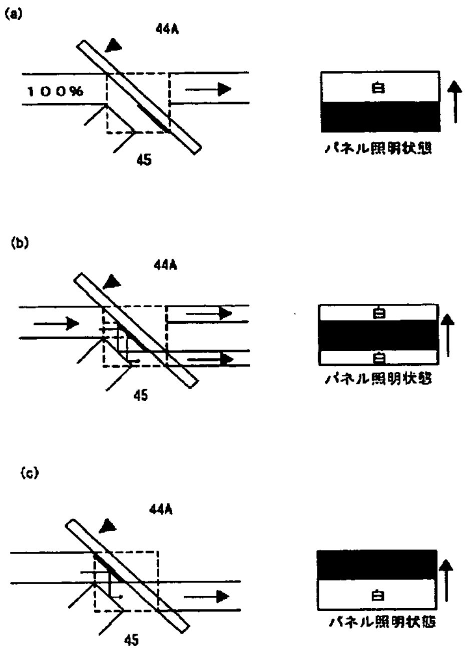
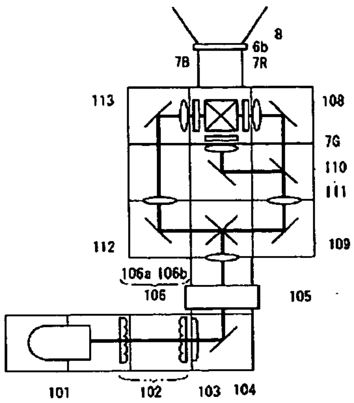

(a)
44A
100%
45
白
パネル照明状態
(b)
44A
45
白
白
パネル照明状態
(c)
44A
45
白
パネル照明状態

【図４１】


8
6b
7B
7R
113
108
7G
110
111
112
109
106a
106b
106
105
101
102
103
104

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